DEPARTMENT OF MATHEMATICS

GRADUATE EMPLOYMENT ATTRIBUTES

EA-1: Sound knowledge and understanding of the domain area.

EA-2: Analytical & critical thinking and problem-solving skills.

EA-3: Scientific Temperament towards Research & Innovation for the Betterment of Society.
EA-4: Efficient Communication & Presentation Skills.

EA-5: Dependability, reliability, responsibility, and independent leadership abilities.

PROGRAM EDUCATIONAL OBJECTIVES

PO-1: The programme covers the full range of mathematics, from classical Calculus to modern Cryptography, Information Theory, and Statistical computation.

PO-2: The course lays a structured foundation of Pure & Applied Mathematics.

PO-3: An exceptionally broad range of topics covering: Linear Algebra, Metric spaces, Statistics, Linear Programming, Numerical Analysis, Mathematical Finance, Coding theory, Mechanics, and Bio- Mathematics cater to varied interests and ambitions.

PO-4: Skill enhancement Courses enable the student acquire the skill relevant to the main subject.
PO-5: The well-structured programme empowers the student with the skills and knowledge leading to enhanced career opportunities in industry, commerce, education, finance and research.

PROGRAM LEARNING OUTCOMES

PLO-1: Communicate mathematics effectively by written, computational and graphic means.

PLO-2: Create mathematical ideas from basic axioms.

PLO-3: Estimate the hypothesis, theories, techniques, and proofs provisionally.

PLO-4: Utilize mathematics to solve theoretical and applied problems by critical understanding, analysis, and synthesis.

PLO-5: Identify applications of mathematics in other disciplines and in the real-world, leading to enhancement of career prospects in a plethora of fields and research.

B.SC (H) MATHEMATICS
[w. e. f. 2024-25]

GRADUATE EMPLOYMENT ATTRIBUTES

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PROGRAM LEARNING OUTCOMES

PLO-1: Communicate mathematics effectively by written, computational and graphic means.

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SEMESTER I

Year/Semester	**1st Year/1st Semester**	**Course Category**	**Major Course**
Course Code	**23MABS101**	**Course Title**	**Calculus**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: XII (Mathematics)		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Know the concepts of limit, continuity and differentiability, Rolle's Theorem and Mean value theorems.
CLO2: Well-versed with the consequences of the intermediate value theorem for continuous functions.
CLO3: Do successive differentiation and know about Leibnitz's theorem.
CLO4: Interpret a function from an algebraic, numerical, graphical and verbal perspective and extract relevant information.
CLO5: Equipped with area and volume of solid of revolution.

Year/Semester	**1st Year/1st Semester**	**Course Category**	**Major Course**
Course Code	**23MABS102**	**Course Title**	**Algebra I**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: XII (Mathematics)		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Know the concepts of groups, rings and fields.
CLO2: Understand the notions of homomorphism and isomorphism in groups, rings, and fields.
CLO3: Design of a quotient groups and rings**.**
CLO4: Quote with polynomial rings.
CLO5: Illustrate with unique factorization domain.

Year/Semester	**1st Year/1st Semester**	**Course Category**	**Minor Stream Course**
Course Code	**23MABS103**	**Course Title**	**Object Oriented Programming Language with C++**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: C Programming Language		**L T P: 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Know the basics of the concept of Object – Oriented Approach.
CLO2: Choose encapsulation, information hiding, abstract data types, Object & classes, attributes, methods.
CLO3: Write inheritance, Class hierarchy, derivation – public, private & protected, Aggregation.
CLO4: Interpret function, function name overloading, overriding inheritance methods, Runtime polymorphism.
CLO5: Streams and files, Namespaces, Exception handling.

Year/Semester	**1st Year/1st Semester**	**Course Category**	**Minor Stream Course**
Course Code	**23MABS103L**	**Course Title**	**Object Oriented Programming Language with C++ Lab**
Continuous Evaluation: 60		**End Semester Examination:40**	

Prerequisite: C Programing	**L T P: 0 0 2**	**Credits: 1**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Know the basics of the concept of Object – Oriented Approach.
CLO2: Choose encapsulation, information hiding, abstract data types, Object & classes, attributes, methods.
CLO3: Write inheritance, Class hierarchy, derivation – public, private & protected, Aggregation.
CLO4: Interpret function, function name overloading, overriding inheritance methods, Runtime polymorphism.
CLO5: Streams and files, Namespaces, Exception handling.

SEMESTER II

Year/Semester	**1st Year/2nd Semester**	**Course Category**	**Major Course**
Course Code	**23MABS201**	**Course Title**	**Algebra II**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: XII (Mathematics)		**L T P: 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Know the concepts of vector space.
CLO2: Understand the notions of linear transformation.
CLO3: Determine basis and dimension of a vector space.
CLO4 Well-versed with characteristic polynomials.
CLO5: Equipped with characteristic roots of a square matrix.

Year/Semester	**1st Year/2nd Semester**	**Course Category**	**Major Course**
Course Code	**23MABS202**	**Course Title**	**Vector Calculus**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: XII (Mathematics)		**L T P: 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Know the concepts of scalar and vector products and find the vector equations of lines and planes.
CLO2: Understand the notions the parametric equations of curves and surfaces.
CLO3: Construction of gradient, divergence and curl of a vector field and prove identities**.**
CLO4: Well-versed with irrotational and solenoidal vector fields.
CLO5: Equipped with various integral theorems.

Year/Semester	**1st Year/2nd Semester**	**Course Category**	**Minor Stream Course**
Course Code	**23MABS203**	**Course Title**	**Python Programming**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: **C Programming Language**		**L T P: 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Demonstrate the usage of basic programs of python programming.

CLO2: Implementation of loops, control flow and different functions.

CLO3: Classify the different data types and their application in different scenarios.

CLO4: Develop advanced programs in python programming using the libraries.

CLO5: Use various visualization tools to develop graphs for data analysis.

Year/Semester	**1st Year/2nd Semester**	**Course Category**	**Minor Stream Course**
Course Code	**23MABS203L**	**Course Title**	**Python Programming Lab**
Continuous Evaluation: 60		**End Semester Examination:40**	
Prerequisite: **C Programming Language**		**L T P : 0 0 2**	**Credits: 1**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Demonstrate the usage of basic programs of python programming.

CLO2: Implementation of loops, control flow and different functions.

CLO3: Classify the different data types and their application in different scenarios.

CLO4: Develop advanced programs in python programming using the libraries.

CLO5: Use various visualization tools to develop graphs for data analysis.

SEMESTER III

Year/Semester	**2nd Year/3rd Semester**	**Course Category**	**Major Course**
Course Code	**23MABS301**	**Course Title**	**Real Analysis**
Continuous Evaluation: 40		**End Semester Examination: 60**	
Prerequisite: Algebra		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Describe and apply the basic properties of real line.

CLO2: Well-versed with the topology of real numbers.

CLO3: Apply the concept of convergence of Sequences of real numbers.

CLO4: Apply the concept of convergence test of series.

CLO5: Be equipped with the notion of arbitrary series.

Year/Semester	**2nd Year/3rd Semester**	**Course Category**	**Major Course**
Course Code	**23MABS302**	**Course Title**	**Ordinary Differential Equations**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Calculus		**L T P: 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Distinguish between linear, nonlinear, partial, and ordinary differential equations.

CLO2: Recognize and solve a homogeneous differential equation and the exact differential equation.

CLO3: Recognize and solve a linear differential equation by use of an integrating factor.

CLO4: Well-versed with basic application problems described by second order linear differential equationswith constant coefficients.

CLO5: Equipped with simultaneous equations.

Year/Semester	**2nd Year/3rd Semester**	**Course Category**	**Major Course**
Course Code	**23MABS303**	**Course Title**	**Theory of Equations**
Continuous Evaluation: 40		**End Semester Examination: 60**	
Prerequisite: XII (Mathematics)		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Make and understand of graphs of different functions.

CLO2: Grasp significance of properties of equations in their solution.

CLO3: Understand relations between roots of equations and its applications

CLO4: Interpret the results using transformation of equations.

CLO5: Equipped with solution of different equations

Year/Semester	**2nd Year/3rd Semester**	**Course Category**	**Minor Stream Course**
Course Code	**23MABS304**	**Course Title**	**Integral Transforms**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Ordinary Differential Equations		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Get an understanding about Laplace-Integral transform.

CLO2: Fluent with the application with Laplace-Integral transform.

CLO3: Study about Dirichlet's conditions, Parseval's identity.

CLO4: Well-versed with solving differential Equations using Fourier Transforms.

CLO5: Get an understanding about relation between Fourier Transforms and Fourier series.

SEMESTER IV

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	23MABS401	Course Title	Multivariate Calculus
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Calculus		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Well-versed with basics of multivariable calculus.

CLO2: Develop students' understanding about the conceptual variations when advancing in calculus from one variable to multivariable discussions.

CLO3: Construct line integral, double and triple integral formulations.

CLO4: Apply the multi variable calculus tools in physics, economics, optimization, and understanding the architecture of curves.

CLO5: Equipped with surfaces in plane and space.

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	23MABS402	Course Title	Mechanics
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Vector Analysis		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Analyze and explain the components of Velocity and acceleration.

CLO2: Know the concept of different Motion in resisting medium.

CLO3: Classify the Motion on smooth and rough plane curves and Rocket motion.

CLO4: Well-versed with Common catenary, Centre of gravity.

CLO5: Equipped with forces in three dimensions.

Year/Semester	2nd Year/4th Semester	Course Category	Major Course
Course Code	23MABS403	Course Title	Partial Differential Equations
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Ordinary Differential Equations		L T P: 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Know about the concepts of partial differential equations.

CLO2: Understand the notions to recognize when partial differential equations are appropriate for creating an appropriate model.

CLO3: Construction of separation of variables, boundary value problems.

CLO4: Well-versed with methods of solving higher-order linear differential equations.

CLO5: Reduce a higher order equation to a system of first order simultaneous equations.

Year/Semester	2nd Year/4th Semester	Course Category	Minor Stream Course
Course Code	23MABS404	Course Title	Operations Research
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Linear Algebra		L T P: 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Solve Linear Programming problems of real-life situations
CLO2: Find the solutions of simplex methods and Big – M methods
CLO3: Calculate the results for sensitivity analysis
CLO4: Solve duality in programming problems
CLO5: Find the solutions of different types of transportation and assignment problems

SEMESTER V

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	23MABS501	Course Title	Number Theory
Continuous Evaluation: 40		End Semester Examination: 60	
Prerequisite: Nil		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Some of the problems related to The Division Algorithm.
CLO2: About The Euclidean Algorithm.
CLO3: About The Fermat Kraitchik Factorization Method.
CLO4: About Congruence, Mobius Inversion Formula.
CLO5: About Legendre Symbol with its properties.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	23MABS502	Course Title	Descriptive Statistics
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Nil		L T P : 3 0 0	Credits: 3

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Describe of different data types and importance of statistics.

CLO2: Present data with different graphs and tables.

CLO3: Illustrate measures of central tendency, dispersion on and understand moments with theiruses.

CLO4: Identify difference between correlation and regression analysis.

CLO5: Estimate Index numbers and their applications on different types of data sets.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	23MABS502L	Course Title	Descriptive Statistics Lab
Continuous Evaluation: 60		End Semester Examination:40	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Describe of different data types and importance of statistics.

CLO2: Present data with different graphs and tables.

CLO3: Illustrate measures of central tendency, dispersion on and understand moments with their uses.

CLO4: Identify difference between correlation and regression analysis.

CLO5: Estimate Index numbers and their applications on different types of data sets.

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	23MABS503	Course Title	Graph Theory and its Applications
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite:		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Understand the basic concepts of graph theory.

CLO2: Illustrate the fundamental applications of Graph Theory in different walks of life.

CLO3: Implement the graph theory in real life problems that can be modelled into graphs.

CLO4: Apply a variety of practical problems in electrical network analysis, in circuit layout, in data structures and in social sciences.

CLO5: Illustrate graph theoretic algorithms and graph theory in Electrical networks

Year/Semester	3rd Year/5th Semester	Course Category	Major Course
Course Code	23MABS504	Course Title	Metric Spaces
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Real Analysis		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Understand the basic concepts of metric spaces.

CLO2: To correlate these concepts to their counterparts in real analysis.

CLO3: Apply the abstractness of the concepts such as open balls, closed balls.
CLO4: Construction of compactness, connectedness etc.

CLO5: Describe compact spaces.

Year/Semester	3rd Year/5th Semester	Course Category	Minor Stream Course
Course Code	23MABS505	Course Title	Riemann Integration & Series of Functions
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Real Analysis and Calculus		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Describe the integration of bounded functions on a closed and bounded interval.
CLO2: Explain different concepts of Improper integral.
CLO3: Apply the concept of convergence of Beta and Gamma functions.
CLO4: Interpret the concept of sequence and series of real valued functions
CLO5: Compile the notion of Power Series

SEMESTER VI

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	23MABS601	Course Title	Topology
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Real Analysis		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Understand basic set theory.
CLO2: Apply the connected property of topological space.
CLO3: Describe the compact topological space.
CLO4: Analyze and apply the separation axiom of topological space.
CLO5: Compile and construct connected and homeomorphism on topological space.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	23MABS602	Course Title	Numerical Methods
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Basic Mathematical Computation		L T P : 3 0 0	Credits: 3

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Know the concepts of Numerical Analysis and demonstrate familiarity with different concepts.
CLO2: Identify the suitable computational technique for a specific type of problem.
CLO3: Describe and apply interpolation.
CLO4: Implement numerical roots of equations by different methods.

CLO5: Construct and compile computational method that is suitable for various problems.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	23MABS602L	Course Title	Programming of Numerical Methods using MATLAB
Continuous Evaluation: 60		End Semester Examination:40	
Prerequisite: Basic Mathematical Computation		L T P : 0 0 2	Credits: 1

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Know the concepts of Numerical Analysis and demonstrate familiarity with different concepts.

CLO2: Identify the suitable computational technique for a specific type of problem.

CLO3: Describe and apply interpolation.

CLO4: Implement numerical roots of equations by different methods.

CLO5: Construct and compile computational method that is suitable for various problems.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	24MABS603	Course Title	Discrete Mathematics
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Algebra		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Understand mathematical logic.

CLO2: Apply the operational property of set theory.

CLO3: Construct and implement the recurrence relations and generating functions.

CLO4: Analyze and calculate shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.

CLO5: Construct and implement the recurrence relations and generating functions.

Year/Semester	3rd Year/6th Semester	Course Category	Major Course
Course Code	23MABS604	Course Title	Complex Analysis
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Calculus		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Know the significance of differentiability of complex functions.

CLO2: Understand the notions of contour integrals.

CLO3: Explain Cauchy-Riemann equations.

CLO4: Interpret the Cauchy-Goursat theorem.

CLO5: Compile Cauchy integral formula and Cauchy Residue theorem.

Year/Semester	3rd Year/6th Semester	Course Category	Minor Stream Course
Course Code	24MABS605	Course Title	Fuzzy Set Theory
Continuous Evaluation: 40		End Semester Examination:60	

Prerequisite: **Set Theory & Analysis**	**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Explain fuzzy sets and fuzzy logic.

CLO2: Describe lattices and graphs.

CLO3: Interpret the fuzzy numbers and arithmetic operations.

CLO4: Compile Logical connectives and fuzzy graphs.

CLO5: Construct and apply logical connectives for fuzzy logic.

Year/Semester	**3rd Year/6th Semester**	**Course Category**	**Minor Stream Course**
Course Code	**23MABS606**	**Course Title**	**Differential Geometry**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Real Analysis		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Know the concepts of space curves, plane curves, and Serret-Frenet formulae.
CLO2: Learn about the relation between tangent, normal, and binormals, the first and second fundamentalforms.
CLO3: Describe the idea of various curvatures.
CLO4: Interpret a developable associated with space curves and curves on surfaces.
CLO5: Compile properties of the geodesic.

SEMESTER VII

Year/Semester	**4th Year/7th Semester**	**Course Category**	**Major Course**
Course Code	**24MABS701**	**Course Title**	**Probability and Probability Distributions**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Knowledge of descriptive statistics		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Understand of the concepts of basic probability and applications of Bayes theorem.

CLO2: Interpret random variables and their properties.

CLO3: Describe applications of two-dimensional random variables and central limit theorem.

CLO4: Find moment generating function and cumulant generating function.

CLO5: Discriminate with discrete and Continuous probability distributions with their properties.

Year/Semester	4th Year/7th Semester	Course Category	Major Course
Course Code	24MABS701L	Course Title	Probability and Probability Distributions Lab
Continuous Evaluation: 60		End Semester Examination:40	
Prerequisite: Knowledge of descriptive statistics		L T P : 0 0 2	Credits: 1

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Get an understanding of variance, covariance, conditional expectation with their related properties.
CLO2: Equipped fitting of different probability distribution.
CLO3: Apply probability distributions on different probability distributions.
CLO4: Understand the real-life applications of Normal distribution.
CLO5: Find Moment generating function, cumulant generating function and characteristic function.

Year/Semester	4th Year/7th Semester	Course Category	Major Course
Course Code	23MABS702	Course Title	Measure Theory and Integration
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite:		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO):

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Describe the shortcomings of Riemann integral and benefits of Lebesgue integral. Fluent with thefundamental concept of measure and Lebesgue measure.

CLO2: Understand the use of the fundamental theorem of calculus.

CLO3: Implement the basic concepts of measure and integration theory.

CLO4: Compile convergence in measure and dominated Convergence theorems.

CLO5: Use Riemann integrable simple functions

Year/Semester	4th Year/7th Semester	Course Category	Major Course
Course Code	24MABS703A	Course Title	Optimization Techniques
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Operation Research		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Define and formulate the problems of game theory.

CLO2: Solve the problems based on sequencing and replacement problems.

CLO3: Understand the concept of network analysis.

CLO4: Conduct and interpret inventory models.

CLO5: Develop mathematical skills to analyze and solve queuing models.

Year/Semester	4th Year/7th Semester	Course Category	Major Course
Course Code	24MABS703B	Course Title	Solid Mechanics
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: Operation Research		L T P : 3 1 0	Credits: 4

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Define state of stress and strains, equilibrium and compatibility

CLO2: Derive the governing equations and their solutions in plane stress state, plane strain state.

CLO3: Explain strain quadric of Cauchy and stress quadric of Cauchy

CLO4: Analyse various stress function

CLO5: Identify and apply various Waves

Year/Semester	4th Year/7th Semester	Course Category	Minor Course
Course Code	23MABS704	Course Title	Cryptography
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: XII (Mathematics)		L T P : 2 0 0	Credits: 2

COURSELEARNING OUTCOMES (CLO)

They syllabus has been prepare in accordance with National Education Policy (NEP). After completion of course, students would able to:

CLO1: Know the concepts of ring, fields and factorizations of polynomials over ring and filed.
CLO2: Well-versed with the consequences of the construction, factorizations of polynomials over finite.fields,
CLO3: Know the concept of basics of cryptography and key cryptosystems.

Year/Semester	4th Year/7th Semester	Course Category	Minor Course
Course Code	24MABS705	Course Title	Data Structures
Continuous Evaluation: 40		End Semester Examination:60	
Prerequisite: C Programming Language		L T P : 2 0 0	Credits: 3

COURSELEARNING OUTCOMES (CLO)

They syllabus has been prepare in accordance with National Education Policy (NEP). After completion of course, students would able to:

CLO1: To prepare data types – Arrays, Strings – Fixed and variable size – static and dynamic strings.

CLO2: To explain class structures as fundamental, modular building blocks, to understand the role of inheritance, polymorphism, dynamic binding, and generic structures in building reusable code.

CLO3: Student will able to analyze the statement of the problem, indexing with binary search trees; a better approach to tree indexes.

CLO4: For the problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.

CLO5: For a given Search problem student will able to implement linear search, binary search.

Year/Semester	**4th Year/7th Semester**	**Course Category**	**Minor Course**
Course Code	**24MABS705L**	**Course Title**	**Data Structures LAB**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: C Programming Language		**L T P : 2 0 0**	**Credits: 1**

COURSELEARNING OUTCOMES (CLO)

They syllabus has been prepare in accordance with National Education Policy (NEP). After completion of course, students would able to:

CLO1: Prepare data types – Arrays, Strings – Fixed and variable size – static and dynamic strings.

CLO2: Explain class structures as fundamental, modular building blocks

CLO3: Understand the role of inheritance, polymorphism, dynamic binding, and generic structures

in building reusable code.

CLO4: Analyze the statement of the problem, indexing with binary search trees; a better approach to tree

indexes.

CLO5: Demonstrate the problem of Stacks, Queues and linked list student will able to implement it

and analyze the same to determine the time and computation complexity.

Year/Semester	**4th Year/7th Semester**	**Course Category**	**Minor Course**
Course Code	**23RMBS710**	**Course Title**	**Research Methodology**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: C Programming Language		**L T P : 2 0 0**	**Credits: 2**

COURSELEARNING OUTCOMES (CLO)

They syllabus has been prepare in accordance with National Education Policy (NEP). After completion of course, students would able to:

CLO1: Describe an idea about research methodology.

CLO2: Understand the applications of sampling schemes and data types and data analysis.

CLO3: Demonstrate and write a report for a particular type of research work.

CLO4: Formulate the presentations method.

Year/Semester	**4th Year/8th Semester**	**Course Category**	**Minor Stream Course**
Course Code	**23MABS705**	**Course Title**	**Statistical Inference**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Basics of statistics and probability		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Illustrate the use of unbiasedness, sufficiency, consistency, and efficiency.

CLO2: Compile the applications of MLE and method of moments.

CLO3: Apply the testing for mean and variance.

CLO4: Discriminate against the applications of MP and UMP.

CLO5:Classify and predict the sequential analysis.

SEMESTER VIII

Year/Semester	**4th Year/8th Semester**	**Course Category**	**Major Course**
Course Code	**23MABS801**	**Course Title**	**Functional Analysis**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Linear algebra, Real analysis, and Metric Spaces		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Describe distance and extension of distance as a norm.

CLO2: Well-versed with central concepts of functional analysis including the Hahn-Banach theorem, the open mapping and closed graph theorems and the uniform boundedness theorem.

CLO3: Apply structural properties of spaces those are constructed with the help of suitable norms

CLO4: Interpret the relationship of differential and integral calculus

CLO5: Classify and design the applications of linear operators, their adjoint operators and properties of bounded

linear operators.

Year/Semester	**4th Year/8th Semester**	**Course Category**	**Major Course**
Course Code	**23MABS802**	**Course Title**	**Special Functions**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: ODE		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Describe the applications and the usefulness of these special functions.

CLO2: Demonstrate the Beta and Gamma functions and their properties.

CLO3: Solve the Legendre equation and Legendre Polynomials.

CLO4: Evaluate and compile the Bessel equations and Bessel functions.
CLO5: Describe and integrate the Hermite equation and Hermite polynomial.

Year/Semester	**4th Year/8th Semester**	**Course Category**	**Major Course**
Course Code	**24MABS803A**	**Course Title**	**Fluid Dynamics**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite:		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Fluent with the basic principles of fluid dynamics.
CLO2: Able to use Euler and Bernoulli's equations
CLO3: Get an understanding the concept of rotational and irrotational flow, stream functions.
CLO4: Able to analyse simple fluid flow problems.
CLO5: Fluent with Complex velocity potential.

Year/Semester	**4th Year/8th Semester**	**Course Category**	**Major Course**
Course Code	**23MABS803**	**Course Title**	**Combinatorial Mathematics**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Modern Algebra, Calculus		**L T P : 3 1 0**	**Credits: 4**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Describe and apply the basics of combinatorics and proofs.
CLO2: Well-versed with the pigeonhole principle, double counting, parity arguments.
CLO3: Apply Principle of Inclusion and Exclusion, Derangements, Inversion formulae and Systems ofdistinct representatives.
CLO4: Apply the concept of Polya theory of counting and their immediate applications.
CLO5: Integrate and estimate Latin squares, Hadamard matrices, combinatorial designs: *t* designs, BIBDs,Symmetric designs.

Year/Semester	**4th Year/8th Semester**	**Course Category**	**Minor Stream course**
Course Code	**23MABS804**	**Course Title**	**Classical Mechanics**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite:		**L T P : 2 0 0**	**Credits: 2**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Apply the concept of D. Alembert's principle in solving problem related to Lagrangian of system.
CLO2: Represent the equation of motion for mechanical systems using Hamiltonian formulations.
CLO3: Apply the concept of transformation in changing the configuration space.

LIVE PROJECTS/ VOCATIONAL COURSES	
Course Code:	Continuous Evaluation: 60 Marks
Credits: 4	End Semester Examination: 40 Marks
Duration: Continuous	Course Type: Skill Enhancement Course
Prerequisite: Nil	

LIVE PROJECT OUTCOMES

On completion of the live project(s), students will be

1. Capable enough to exhibit strong foundation knowledge of domain area.
2. Students can take a challenge and place better career development scenario in professional life.
3. It gives a strong boost for experienced to take their career into next stage.
4. Successfully completion of live projects shows a better stand and technical expertise in domain area.

SUMMER INTERNSHIP	
Course Code:	Continuous Evaluation: 60 Marks
Credits: 4	End Semester Examination: 40 Marks
Duration: 3 / 4 Weeks	Course Type: Skill Enhancement Course
Prerequisite: Nil	

COURSE LEARNING OUTCOMES

On completion of course, students will be

CLO1: Able to demonstrate various aspects of theory as well as practical.

CLO2: Able to build and expand network of professional relationships and contacts.

CLO3: Develop a solid work ethic and professional demean our, as well as a commitment to ethical conduct and social responsibility.

CLO4: At the end of the course, a student will be competent in their domain area.

List of Multidisciplinary Courses (MDC) offered to Four Year B.Sc. Mathematics programme in the Department of Mathematics

Year/Semester	**Ist Year / Ist Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC201**	**Course Title**	**Renewable Energy Sources**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO) : At the end of the course, the student will be able to

CLO1: Analyze the energy scenario of the world and nation.

CLO2: Carry out a comparative analysis of different types of coal, including their treatment, Liquefaction and gasification.

CLO3: Compare the liquid and gaseous fuels sourced from petroleum including their characterization.

CLO4: Analyze the potential of alternate energy sources and their scope and limitations.

Year/Semester	**Ist Year / Ist Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC202**	**Course Title**	**Electric Vehicles**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO):

At the end of the course, the student will be able to

CLO1: Realize the importance of electric transportation systems.

CLO2: Understand the basics of electric vehicle components and configuration.

CLO3: Understand the various charging types, comfort and safety methods.

CLO4: Understand the application of electric vehicle in Smart grid.

DEPARTMENT OF LAW			
Year/Semester	**Ist Year / Ist Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC301**	**Course Title**	**IPR for Business**
Continuous Evaluation: 40		**End Semester Examination: 60**	
Prerequisite: Nil		**L T P: 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES

At the end of this course, the students would be able to:

CLO1: Define and discuss about the various types of IPR and its relevance for business

CLO2: Discuss the adjudicating bodies and mechanisms under each of these IPRs

CLO3: Analyze and resolve business disputes relating to IPR

CLO4: Apply the learning to the real-life situations in business

Department of Library & Information Science			
Year/Semester	**Ist Year /Ist Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC302**	**Course Title**	**Library Information Science & Media Literacy**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

CLO-1: Explain the library collection and their classifications.

CLO-2: Analyse the library information services.

CLO-3: Analyse the media roles.

CLO-4: Analyse the motive of media.

Year/Semester	**Ist Year /Ist Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC401**	**Course Title**	**Management Process & Organizational Behaviour**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Demonstrate the roles, skills and functions of management.

CLO2: Analyse the causes and consequences of applying different business strategies.

CLO3: Analyse and compare individual behaviour related to motivation and rewards.

CLO4: Identify group behaviour, leadership styles and the role of leaders in a decision makingprocess.

Department of Mechanical Engineering			
Year/Semester	**Ist Year/IInd Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC204**	**Course Title**	**Introduction to Robotics**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO) : At the end of the course, the student will be able to

CLO1: Explain basic concepts of Programmable Logic Controller (PLC) and Industrial automation.

CLO2: Determine basic programming languages and instructions of a PLC and Use a particular Programmable Logic Controller (PLC) for various applications.
CLO3: Design an automated system for industrial derive to meet defined operational specifications.
CLO4: Explain basic concept, type and components of Robotic system and Define the principles and benefits of the various actuators, drives and sensors. Solve forward kinematics of any serial robot, compute position and orientation of end effectors as a function to joint variables.

Department of Psychology			
Year/Semester	**Ist Year/IInd Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC303**	**Course Title**	**Psychology and Emotional Intelligence**
Continuous Evaluation: 40		**End Semester Examination : 60**	
Prerequisite: NIL		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES

CLO1: Describe the basic concepts in psychology
CLO2: Get equipped with various psychological techniques used to assess human behavior at various developmental stages
CLO3: Develop an overview of psychology that would lead to better communication and enhance adjustment in work and personal life
CLO4: Learn the skills for applying knowledge to real life situations so as to improve interpersonal interactions and adjustment in life

Department of Economics			
Year/Semester	**Ist Year / IInd Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC304**	**Course Title**	**Indian Economy**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Review major demographic indicators
CLO2: Comprehend the concept of inequality
CLO3: Analyse agriculture sector

Department of ECE			
Year/Semester	**IInd Year / IIIrd Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC205**	**Course Title**	**Arduino Based Programming**
Continuous Evaluation: 40		**End Semester Examination:60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

Course Learning Outcomes (CLO):The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to

CLO1: Demonstrate a clear understanding of Arduino's architecture, components, and capabilities.

CLO2: Write, upload, and debug Arduino sketches using the Arduino IDE.

CLO3: Integrate various sensors and retrieve data from the physical world.

CLO4: Control actuators to produce desired physical effects or actions.

CLO5: Design and complete Arduino-based projects from ideation to implementation.

Department of Political Science			
Year/Semester	**IInd Year / IIIrd Semester**	**Course Category**	**Multidisciplinary Course**
Course Code	**23MDC305**	**Course Title**	**Electoral Literacy in India**
Continuous Evaluation : 40		**End Semester Examination : 60**	
Prerequisite: Nil		**L T P : 3 0 0**	**Credits: 3**

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

CLO1: The student shall be able to understand the meaning, definition, and significance of electionsin India.

CLO2: The course will help the students to analyse and understand electoral institutions, and theirrole and functions in the conduct of free and fair elections.

CLO3: The student shall be able to know the party system of India.

CLO4: The course will help the student understand issues and challenges in conducting free and fairelections in India.

List of Ability Enhancement Courses (AEC) offered to Four Year B.Sc. Mathematics programme in the Department of Mathematics

Department of English			
Year/Semester	**Ist Year / Ist Semester**	**Course Category**	**Ability Enhancement Courses**
Course Code	**23AEC101**	**Course Title**	**Functional English-I**
Continuous Evaluation : 40		**End Semester Examination : 60**	
Prerequisite: Nil		**L T P : 2 0 0**	**Credits: 2**

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

CLO1: Demonstrate comprehensive and fluent communication in standard English – written &spoken

CLO2: Apply the skills to engage in group discussions, debate, deliver speeches and such others.

CLO3: Analyse texts on various parameters expected/demanded during different situations and circumstances

CLO4: Integrate the knowledge and skills to prepare basic/preliminary research documents, official documents and deliver presentations on a given topic

Department of English			
Year/Semester	**Ist Year / IInd Semester**	**Course Category**	**Ability Enhancement Courses**
Course Code	**23AEC201**	**Course Title**	**Functional English - II**
Continuous Evaluation : 40		**End Semester Examination : 60**	
Prerequisite: Nil		**L T P : 2 0 0**	**Credits: 2**

Course Learning Outcomes (CLO): – The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

CLO1: Illustrate the stylistic conventions of academic writing.

CLO2: Analyse readings critically by evaluating the various contexts (social, historical, or personal) surrounding and underpinning each text.

CLO3: Evaluate various texts while identifying and highlighting their main ideas and messages

CLO4: Develop independent perspectives and arguments via persuasive support and successful incorporation of research thus developing their own voice and creating a balance between their own voice and source summaries.

CLO5: Assess counter arguments in order to present a more compelling argument

Year/Semester	**Ist Year / IIIrd Semester**	**Course Category**	**Ability Enhancement Courses**
Course Code	**23FLGR201 I**	**Course Title**	**German - I**
Continuous Evaluation : 40		**End Semester Examination : 60**	
Prerequisite: Nil		**L T P : 2 0 0**	**Credits: 2**

COURSE LEARNING OUTCOMES (CLO)

CLO1: After completion of this student will be able to read and write short, simple texts.
CLO2: After completion of this student will have Fluency in reading and writing.
CLO3: After completion of this student will be able understand a dialogue between two nativespeakers and to take part in short, simple conversations using the skills acquired.
CLO4: Student will able to know the culture of the countries where the German language isspoken.
CLO5: Developing pronunciation so that they can read the text and e-mail during their employment, instructing them to write their own CV and developing a fundamentalconversation with any German national.

Year/Semester	**Ist Year / IVth Semester**	**Course Category**	**Ability Enhancement Courses**
Course Code	**23FLGR201 II**	**Course Title**	**German - II**
Continuous Evaluation : 40		**End Semester Examination : 60**	
Prerequisite: Nil		**L T P : 2 0 0**	**Credits: 2**

COURSE LEARNING OUTCOMES (CLO)

CLO1: After completion of this student will be able to read and write short, simple texts.
CLO2: After completion of this student will have Fluency in reading and writing.

CLO3: After completion of this student will able to use language creatively and spontaneously.

CLO4: Students will get awareness of cross-cultural and intercultural difference.

Year/Semester	Ist Year / IIIrd Semester	Course Category	Ability Enhancement Courses
Course Code	23FLFR201 I	Course Title	French - I
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

COURSE LEARNING OUTCOMES (CLO)

CLO1: After completion of this course, the student will be able **to express and interact in French** used in daily conversations.

CLO2: The student will be able **to write short and simple texts.**

CLO3: The student will be able to **initiate and respond to various situations** using French language skills.

CLO4: The student can **understand and respond** effectively to the cultural elements of the French and Francophone culture

Year/Semester	Ist Year / IVth Semester	Course Category	Ability Enhancement Courses
Course Code	23FLFR201 II	Course Title	French - II
Continuous Evaluation : 40		End Semester Examination : 60	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

COURSE LEARNING OUTCOMES (CLO)

CLO1: After completion of this course, the student will be able **to express and interact in French** used in daily conversations.

CLO2: The student will be able **to write short and simple texts.**

CLO3: The student will be able to **initiate and respond to various situations** using French language skills.

CLO4: The student can **understand and respond** effectively to the cultural elements of the French and Francophone culture.

List of Value Added Courses (VAC) offered to Four Year B.Sc. Mathematics programme in the Department of Mathematics

DEPARTMENT OF LAW			
Programme: Undergraduate program			
Year/Semester	Ist Year / Ist Semester	Course Category	Value Added Course (VAC)
Course Code	23VAC102	Course Title	Indian Constitution & Polity
Continuous Evaluation: 30		End Semester Examination: 70	
Prerequisite: Nil		L T P : 2 0 0	Credits: 2

Course Learning Outcomes (CLO) – At the end of this course, the learners are expected to:

CLO1: Explain the concept of democracy, diversity and the Constitutional Values

CLO2: Describe the functioning of the three wings of the State

CLO3: Sketch the functioning of decentralised administration under the Constitution of India and appreciate the political dimensions.

CLO4: Examine the scope of various rights and duties under the Constitution of India.

Department of Environmental Sciences			
Programme: Undergraduate program			
Year/Semester	**Ist Year / IInd Semester**	**Course Category**	**Value Added Course (VAC)**
Course Code	**23VAC101**	**Course Title**	**Environmental Protection & Sustainable development**
Continuous Evaluation: 30		**End Semester Examination: 70**	
Prerequisite: Nil		**L T P : 2 0 0**	**Credits: 2**

Course Learning Outcomes (CLO) – The Syllabus has been prepared in accordance with the NEP-2020 and based on the UGC curriculum framework. Upon completion of this course, learners will be able to:

CLO1: Demonstrate to safeguard the Earth's environment and its resources.
CLO2: Explain sustainable development, its goals, challenges, and global strategies.
CLO3: Analyse the environmental pollution and sensitize themselves to adverse health impacts of pollution.
CLO4: Appraise the concept of climate change, its science and response measures.

Department of Physical Education & Sports			
Programme: Undergraduate program			
Year/Semester	**IInd Year / IIIrd Semester**	**Course Category**	**Value Added Course (VAC)**
Course Code	**23VAC103**	**Course Title**	**Sports, Yoga & Fitness**
Continuous Evaluation: 80		**End Semester Examination: 20**	
Prerequisite: Nil		**L T P : 0 0. 4**	**Credits: 2**

Course Learning Outcomes (CLO)–The Syllabus has been prepared in accordance with the NEP-2020. Upon completion of this course, learners will be able to:

CLO1: Explain the role of yoga and fitness in life.
CLO2: Apply the rules of healthy and fit life
CLO3: Analyse the ways and methods of yoga and sports
CLO4: Recommend the practices of Asanas and different sports
CLO5: Integrate the concept of yoga and sports in all round development of students and beings.

List of Skill Enhancement Courses (SEC) offered to Four Year B.Sc. Mathematics programme in the Department of Mathematics

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Science & Humanities**		
Year / Semester	**1 / 1**	**Course Category**	**SEC (soft skills)**
Course Code	**23SS151**	**Course Title**	**Effective Communication Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

TLO1. To communicate effectively and interact with people with confidence.
TLO2. To demonstrate and differentiate between various forms of communication.
TLO3. To apply effective communication skills confidently which a student need to get ahead in job and life.

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Science & Humanities**		
Year / Semester	**1 / 2**	**Course Category**	**SEC (soft skill)**
Course Code	**23SS252**	**Course Title**	**Teamwork & Interpersonal Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

TLO1. To be confident working in a team and leading it as well.
TLO2. To categorize the work and achieve expected performance within the time frame& will be able to adapt himself to work under various kinds of stress and re-energies himself to bounce back from such situations.
TLO3. To get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.
TLO4. To face complex problems and effectively deal with it in the job due to Critical Thinking & Problem Solving Skills.

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Science & Humanities**		
Year / Semester	**2 / 3**	**Course Category**	**SEC (soft skill)**
Course Code	**23SS353**	**Course Title**	**Presentation Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Learning Outcomes (TLO): -

After the completion of the training, the student will have ability:

TLO1. To be confident in presenting himself in front of audience.
TLO2. To become professional in his approach towards work culture.
TLO3. To enhance the level communication skills while interacting with others.

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Science & Humanities**		
Year / Semester	**2 / 4**	**Course Category**	**SEC (soft skill)**
Course Code	**23SS454**	**Course Title**	**Professional Skills**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Learning Outcomes (TLO):

After the completion of the training, the student will have ability:

TLO1. To understand the importance of professional writing required in workplace.
TLO2. To explore different formats in resume, cover letters & other business relatedletters.
TLO3. To develop knowledge, skills and understanding people in-group and individually.
TLO4. To apply communication strategies either in-group or one on one basis and willbe confident to lead the discussion among them.

Department Of Training & Placement			
Training Cell			
Programme	**Faculty of Science & Humanities**		
Year / Semester	**3 / 5**	**Course Category**	**SEC (soft skill)**
Course Code	**23AR555**	**Course Title**	**Aptitude & Reasoning**
Continuous Evaluation: 70		**End Term Examination: 30**	
Prerequisite: Nil		**L T P: 0 0 2**	**Credits: 1**

Training Learning Outcomes (TLO):

After the completion of the training, the student will have ability:

TLO1. To understand the basic concepts of quantitative ability.
TLO2. To solve campus placements aptitude papers covering Quantitative Ability.
TLO3. To Compete in various competitive exams like CAT, CMAT, GATE, GRE, GATE, UPSC, GPSC etc.

DIGITAL LITERACY & IT SKILLS	
Course Code:	Continuous Evaluation: 60 Marks
Credits: 1	End Semester Examination: 40 Marks
L T P : 0 0 2	**Course Type:** Skill Enhancement course (Technical skills)
Prerequisite: NIL	

COURSE LEARNING OUTCOMES

CLO1: Understand the basic fundamental components of computers including the working of internet.
CLO2: Familiarize in working of MS-Word including creating and modifying the text documents and its conversion into different other formats like pdf. etc.
CLO3: Students will be able to apply different formulas in the Excel sheets to solve complex business problems.
CLO4: Ability to create a good interactive presentation using MS-PowerPoint.
CLO5: Ability to enhance the data analytics practices executed in the business world.
CLO6: Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.
CLO7: Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.
CLO8: Demonstrate the types of machine learning: Supervise learning, unsupervised learning, and deep learning.
CLO9: Describe popular algorithms Classification, Regression, Clustering, and Dimensional Reduction.
CLO10: Analyse the factors that influenced the advancements of AI in recent years.

Department of Mathematics			
Year/Semester	**1 Year/ 2nd Semester**	**Course Category**	**Skill enhancement course (SEC) (Technical Skills)**

Course Code	23SS202	Course Title	Advance Excel Skills
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE LEARNING OUTCOMES (CLO)

On successful completion of the course, students will be able to do following:

CLO1: To optimize the use of MS-Excel for powerful data analysis.

CLO2: To apply correct data visualization technique to gain optimal presentation of data.

CLO3: To apply enhanced features of MS-Excel

Department of Mathematics			
Year/Semester	2nd Year/ 3rd Semester	Course Category	Skill enhancement course (SEC) (Technical skills)
Course Code	23SS303	Course Title	Statistical Analysis with SPSS
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE LEARNING OUTCOMES (CLO)

On successful completion of the course, students will be able to do following:

CLO1: Basics of SPSS

CLO2: Understanding of data handling in SPSS

CLO3: Diagrammatic representation of data

Department of Mathematics			
Year/Semester	2nd Year/ 4th Semester	Course Category	Skill enhancement course (SEC)
Course Code	23SS404	Course Title	R Language Programming
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE LEARNING OUTCOMES (CLO)

On successful completion of the course, students will be able to do following:

CLO1: Develop an R script and execute it

CLO2: Install, load and deploy the required packages, and build new packages for sharing and reusability

CLO3: Extract data from different sources using API and use it for data analysis

Department of Mathematics			
Year/Semester	3rd Year/ 5th Semester	Course Category	Skill enhancement course (SEC)
Course Code	23SS505	Course Title	Programming with MATLAB
Continuous Evaluation: 80		End Semester Examination: 20	
Prerequisite: Nil		L T P : 0 0 2	Credits: 1

COURSE LEARNING OUTCOMES (CLO)

CLO1: Understand the basics of MATLAB.

CLO2: Apply MATLAB software for basic matrix computation problems through loops.

CLO3: Demonstrate MATLAB software to solve various mathematical problems numerically.

M.SC. MATHEMATICS

[w. e. f. 2024-25]

GRADUATE EMPLOYABILITY ATTRIBUTES

EA 1: Sound knowledge and understanding of the domain area.

EA 2: Analytical & critical thinking and problem solving skills.

EA 3: Scientific Temperament towards Research & Innovation for the Betterment of Society.

EA 4: Efficient Communication & Presentation Skills.

EA 5: Dependability, reliability, responsibility, and independent leadership abilities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The objectives of the M.Sc. Mathematics program are to develop students with the following capabilities:

PEO 1: To provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.

PEO 2: To provide students with advanced mathematical and computational skills that prepares them to pursue higher studies and conduct research.

PEO 3: To motivate the students for research studies in mathematics and related fields.

PEO 4: To provide students with a knowledge, abilities and insight in Mathematics and computational techniques so that they are able to work as mathematical professional.

PEO 5: To provide students with knowledge and capability in formulating and analysis of mathematical models of real-life applications.

PROGRAM LEARNING OUTCOMES (PLOs)

After successful completion of this program, the students will be able to:

PLO 1: Apply knowledge of Mathematics, in all the fields of learning, including higherresearch and its extensions.

PLO 2: Carry out development work as well as take up challenges in the emerging areas ofthe industry.

PLO 3: Demonstrate competence in using mathematical and computational skills to model, formulate and solve real life applications.

PLO 4: Crack lectureship and fellowship exams approved by UGC like CSIR – NET andSET/ ISRO/DRDO.

PLO 5: Enhance the ability to establish advanced independent critical enquiry and analysis.

SEMESTER-I

Abstract Algebra	
Course Code: 24MAMS101	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Learn to construct and describe groups.
CLO2: To describe the properties of groups and get familiar with important classes of groups.
CLO3: Apply Sylow's theorems to describe the structure of some finite groups.
CLO4: Become familiar with rings, integral domain and their arithmetic.
CLO5: Understand the concept of fields.

Real Analysis	
Course Code:24MAMS102	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
CLO2: Demonstrate an understanding of limits and how that is used in sequences, series of functions and their convergence.
CLO3: Construct rigorous mathematical proofs of basic results in real analysis.
CLO4: Apply Cauchy Criterion, Weierstrass M-test, Abel‟s and Dirichlet‟s tests.
CLO5: Define Metric spaces and its properties.

Complex Analysis	
Course Code: 24MAMS103	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Define continuity and differentiability of complex functions.
CLO2: Prove the Cauchy-Riemann equations and apply them to complex functions in order to determine whether a given continuous function is complex differentiable.
CLO3: Compute the radius of convergence for complex power series.
CLO4: Evaluate integrals along a path - directly from the definition and also via the Fundamental

Theorem of Contour Integration and Cauchy's Theorem.
CLO5: Compute the Taylor and Laurent expansions of simple functions, determining the nature of the singularities and calculating residues.

Advanced Ordinary Differential Equations	
Course Code:24MAMS104	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Find the solutions of first and higher order ODEs.
CLO2: Discuss the existence and uniqueness of solutions of given IVP.
CLO3: Solve ordinary differential equations by Power series solution and special functions.
CLO4: Model some physical problem and give physical interpretation of the solution.
CLO5: Do stability analysis of the systems which arise in different areas of science and engineering.

Linear Algebra	
Course Code:24MAMS201	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Understand the notion of a vector space and linear transformation.
CLO2: Determine basis and dimension of a vector space.
CLO3: Find the characteristic polynomial and characteristic roots of a square matrix.
CLO4: Get an understanding of minimal polynomial and annihilators
CLO5: Compute an orthogonal basis using the Gram-Schmidt process.

Numerical Analysis	
Course Code:24MAMS202	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Demonstrate understanding of common numerical methods and how they are used to obtain approximate values.
CLO2: Describe various difference operators
CLO3: Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration
CLO4: Find the solution of linear and nonlinear equations
CLO5: Find numerical solutions of differential equations.

Discrete Mathematics	
Course Code:24MAMS203	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Formulate and interpret statements presented in Boolean logic.
CLO2: Apply truth tables.
CLO3: Know Tautologies, Contradictions and recurrence relations
CLO4: Describe POSET, lattices and their properties.
CLO5: Develop graphs and their types and find Minimal Spanning Tree

Integral Equations	
Course Code: 24MAMS204	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	Course Category: Core Course
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of course, students would be able to:

CLO1: Understand the properties of geometrical problems.
CLO2: Describe variational problems and their solutions.
CLO3: Well-versed with isoperimetric problems and their solutions.
CLO4: Get an understanding of different types of integral equations.
CLO5: Expose to the decomposition method.

SEMESTER III

Topology	
Course Code: 24MAMS301	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

CLO1: Able to construct topological spaces from metric spaces and using general properties of neighborhood, open sets, close sets, basis and sub-basis.
CLO2: Fluent with the properties of open sets, close sets, interior points, accumulation points and derived sets in deriving the proofs of various theorems.
CLO3: To discuss the concepts of countable spaces and separable spaces.
CLO4: Able to understand the concepts and properties of the compact and connected topological spaces.
CLO5: Get an understanding of the concepts – T_0, T_1, T_2, T_3, $T_{3½}$, T_4.

.Partial Differential Equations	
Course Code: 24MAMS302	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

CLO1: Able to understand the partial differential equation problem.

CLO2: Fluent with linear and non-linear systems.

CLO3: Able to solve the first-order linear and non-linear PDEs by using transform methods and other methods.

CLO4: Able to determine the solutions of linear PDEs of second and higher order with constant coefficients.

CLO5: Able to know Hop-Lax formula, Weak solutions.

Operations Research	
Course Code: 24MAMS303	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: Linear Algebra	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Get an understanding of real-life problems into Linear programming problems.

CLO2: Able to use the simplex method to find an optimal vector for the standard linear programming problem and the corresponding dual problem.

CLO3: Able to find the optimal solution of transportation problem.

CLO4: Get an understanding of the constructions of the networks of a project and optimal scheduling using CPM and PERT.

CLO5: Able to solve Game theory problems.

SEMESTER IV

Functional Analysis	
Course Code: 24MAMS401	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: Core Course**
Prerequisite: Topology	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

CLO1: Able to understand the use of duality in various contexts and theoretical results from the course in concrete situations.
CLO2: Fluent with families of applications appearing in the course, particularly specific calculations needed in the context of Baire's Category.
CLO3: Produce examples and counter examples illustrating the mathematical concepts presented in the

course.

CLO4: Able to understand the statements and proofs of important theorems and explain the key stepsin proofs, sometimes with variation.

CLO5: Knowledge of open mapping and closed graph theorem.

Measure Theory and Integration	
Course Code: 21MAMS402	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P: 3 1 0	**Course Category: Core Course**
Prerequisite: Set Theory	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

CLO1: Able to describe the short comings of Riemann integral and benefits of Lebesgue integral.
CLO2: Fluent with the fundamental concept of measure and Lebesgue measure.
CLO3: Get an understanding of the uses of fundamental theorem of calculus.
CLO4: Get an understanding of the basic concepts of measure and integration theory.
CLO5: Get an understanding of convergence in measure and dominated Convergence theorems.

DEPARTMENT SPECIFIC ELECTIVE – I

Number Theory	
Course Code: 24MAMS105	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Define and interpret the concepts of divisibility, congruence, greatest common divisor, prime, and prime-factorization

CLO2: Understand the concepts of arithmetical functions, prove and apply properties of number theoretic functions such as the Euler's phi function and of residues modulo n.

CLO3: Solve congruence's of various types and use the theory of congruence's in applications.

CLO4: Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues

CLO5: Understand the concepts of factorization of polynomials.

Computer Programming using MATLAB	
Course Code:21MAMS106	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 0 2	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of

course, students would be able to:

CLO1: Understand the basics of MATLAB.
CLO2: Apply MATLAB software for basic matrix computation problems through loops.
CLO3: Demonstrate MATLAB software to solve various Linear algebra problems numerically.
CLO4: Find the solutions of linear and nonlinear equations, and numerical integration using MATLAB.
CLO5: Solve different types of mathematical problems and draw various types of graphs using MATLAB.

Financial Mathematics	
Course Code:21MAMS107	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: Nil	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Demonstrate understanding of basic concepts in linear algebra, relating to linear equations, matrices, and optimization.
CLO2: Understand the concepts relating to functions and annuities.
CLO3: Employ methods related to these concepts in a variety of financial applications.
CLO4: Apply logical thinking to problem solving in context.
CLO5: Use appropriate technology to aid problem solving.

DEPARTMENT SPECIFIC ELECTIVE – II

Mathematical Statistics- I	
Course Code: 24MAMS205	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of course, students would be able to:

CLO1: To know about probability and probability distributions

CLO2: Understand the transformation of random variables, central limit theorem, and its application.

CLO3: Construct and interpret properties of estimator

CLO4: Perform hypothesis for large samples testing problems in real life examples

CLO5: Perform hypothesis for small samples testing problems in real life examples

PYTHON PROGRAMMING	
Course Code: 24MAMS208	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 0 2	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of course, students would be able to:

CLO1: Demonstrate the usage of basic programs of python programming.
CLO2: Demonstrate the usage of loops, control flow and different functions.
CLO3: Classify the different data types and their application in different scenarios.
CLO4: Develop advanced programs in python programming using the libraries.
CLO5: Use various visualization tools to develop graphs for data analysis.

Coding theory and Cryptography	
Course Code: 24MAMS207	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Define and interpret the concepts code.

CLO2: Understand the concepts of arithmetical functions, prove and apply properties of number theoretic functions such as the Euler's phi function and of residues modulo n.

CLO3: Solve various types a problems of code.

CLO4: Apply the Weight distribution of codes.

CLO5: Understand the concepts of DES-security and RSA.

DEPARTMENT SPECIFIC ELECTIVE – III

Fluid Dynamics	
Course Code: 24MAMS304	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of course, students would be:

CLO1: Fluent with the basic principles of fluid dynamics.
CLO2: Able to use Euler and Bernoulli's equations and the conservation of mass to determine velocityand acceleration for incompressible and inviscid fluid.
CLO3: Get an understanding the concept of rotational and irrotational flow, stream functions, velocity potential, sink, source, vortex, etc.
CLO4: Able to analyse simple fluid flow problems (flow between parallel plates, flow through pipe,etc.) with Navier - Stoke's equation of motion.
CLO5: Fluent with Complex velocity potential.

Computing with C++	
Course Code: 24MAMS305	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**

L T P : 3 0 2	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Understand Decision making and branching and looping.
CLO2: Apply Arrays, Character and strings, User- defined functions, recursion functions.
CLO3: Understand Storage class of Variables, Pointers, Pointers and arrays, arrays of pointers, pointers as function
CLO4: Apply Arguments, functions, returning pointers, Structure, array of structures, structure pointers.
CLO5: Apply Dynamic memory allocation functions, Pre-processors: Macro substitution, macro with argument, File inclusion in C++, I/O operations on files.

Mathematical Statistical -II	
Course Code: 24MAMS306	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be:

CLO1: Able to know the concept of sampling theory

CLO2: Able to apply non parametric test in real life situations

CLO3: Get an understanding of multivariate analysis

CLO4: Get an understanding of different designs of experiments

CLO5: Get an understanding of different factorial experiments

DEPARTMENT SPECIFIC ELECTIVE – IV

Mechanics	
Course Code: 24MAMS307	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of course, students would be:

CLO1: Get an understanding of the dynamics involving a single particle like projectile motion, Simple harmonic motion, pendulum motion and related problems.
CLO2: Well-versed with the path described by the particle moving under the influence of central forces.
CLO3: Able to apply the concept of system of particle in finding moment inertia, directions of principle axes and consequently Euler's dynamical equations for studying rigid body motions.

CLO4: Able to represent the equation of motion for mechanical systems using the Lagrangian and Hamiltonian formulations of classical mechanics.
CLO5: Get an understanding of canonical equations using different combinations of generating functions and subsequently developing Hamilton Jacobi method to solve equations of motion.

Mathematical Programming	
Course Code: 24MAMS308	**Continuous Evaluation: 40 Marks**
Credits: 4	**End Semester Examination: 60 Marks**
L T P : 3 1 0	**Course Category: DSE**
Prerequisite: Linear Algebra	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of course, students would be:

CLO1: Get an understanding of convex sets and functions and application of Kuhn-Tucker conditionsof optimality.
CLO2: Fluent with mathematical programming model of a real-life situation.
CLO3: Able to apply a branch and bound algorithm to solve integer programming problems.
CLO4: Able to apply Wolfe's algorithm and Beale's algorithm for quadratic programming.
CLO5: Get an understanding of the basic theory of separable programming.

DATA STRUCTURES USING C	
Course Code: 24MAMS310	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 0 2	Course Category: DSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:
CLO1: Analyse the algorithms to determine the time and computation complexity and justify the correctness.
CLO2: Implement the given search problem, i.e., Linear and Binary Search.
CLO3: Write and analyse an algorithm for different sorting techniques and compare their performance in term of Space complexity, Time complexity and application.
CLO4: Implement any given problem of Stacks, Queues and linked list and analyze the same to determine the time and computation complexity.
CLO5: Identify the best data structure to be used for any particular application and design and analyses the application in terms of time and space complexity.

DEPARTMENT SPECIFIC ELECTIVE – V

Modelling and Simulation	
Course Code:24MAMS403	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	Course Category: DSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). Aftercompletion of

course, students would be able to:

CLO1: Apply Simulation and Monte Carlo integration.
CLO2: Discuss and get equipped with different models to population dynamics
CLO3: Illustrate inverse transform method and convolution method.
CLO4: Illustrate outcomes against design criteria
CLO5: Know Markov Chain Monte-Carlo simulation and Metropolis-Hastings algorithm

Algebraic Topology	
Course Code: 24MAMS404	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	Course Category: DSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Grasp the basics of Algebraic Topology.
CLO2: Determine fundamental groups of some standard spaces like Euclidean spaces and spheres.
CLO3: Understand proofs of some beautiful results such as Fundamental theorem of Algebra,Hurwicz uniformization theorem, Borsuk‟s separation theorem.
CLO4: Describe the topology of En
CLO5: Classify the Surfaces and Covering Spaces

Theory of Elasticity	
Course Code: 24MAMS405	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	Course Category: DSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Define state of stress and strains, equilibrium and compatibility
CLO2: Derive the governing equations and their solutions in plane stress state, plane strain state.
CLO3: Explain strain quadric of Cauchy and stress quadric of Cauchy
CLO4: Analyse various stress function
CLO5: Identify and apply various Waves

DEPARTMENT SPECIFIC ELECTIVE –VI

Differential Geometry	
Course Code: 24MAMS406	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	Course Category: DSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Compute quantities of geometric interest such as curvature and torsion.

CLO2: Introduce the method of the moving frame and over determined systems of differential equations as they arise in surface theory.
CLO3: Calculate the involute and evolute of a curve.
CLO4: Calculate the first and the second fundamental forms of a surface.
CLO5: Calculate the Gaussian curvature, the mean curvature, the curvature lines, the asymptotic lines, the geodesics of a surface.

Stochastic Processes	
Course Code: 24MAMS407	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 1 0	Course Category: DSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Learn about stochastic processes, their classifications and real-life applications.
CLO2: Understand the concept of Markov chains and to obtain higher transition probabilities.
CLO3: Explain various properties of a Poisson process.
CLO4: Demonstrate the ideas of birth and death process, immigration-emigration process, renewal process, Regenerative stochastic process, Markov renewal process and semi- Markov process.
CLO5: Apply the stochastic theory for modelling real systems/ phenomena and study their implications, including the reliability of the systems.

Computing with R	
Course Code: 21MAMS408	Continuous Evaluation: 40 Marks
Credits: 4	End Semester Examination: 60 Marks
L T P : 3 0 2	Course Category: DSE
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

The syllabus has been prepared in accordance with National Education Policy (NEP). After completion of course, students would be able to:

CLO1: Write the programs for statistical software.
CLO2: Apply programming skills in methods and algorithms useful in probability, statistics and data analysis.
CLO3: Get equipped with examples related to random number generation, matrix computations
CLO4: Apply graphics to Represent multivariate data and descriptive statistics.
CLO5: Execute the skill regarding R computations.