

Department of Mathematics

B.Sc. (H) – Mathematics

[w.e.f. 2023-24]

Department of Mathematics

PROGRAMME LEARNING OUTCOME (PLOs)

The completion of the BMH Programme will enable a student to:

PLO1: Communicate mathematics effectively by written, computational and graphic means.

PLO2: Create mathematical ideas from basic axioms.

PLO3: Estimate the hypothesis, theories, techniques and proofs provisionally.

PLO4: Reproduce mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis.

PLO5: Compile applications of mathematics in other disciplines and in the real-world, leading to enhancement of career prospects in a plethora of fields and research.

PROGRAMME SPECIFIC OBJECTIVE (PSOs)

PSO1: To develop structured foundation of Pure & Applied Mathematics.

PSO2: To facilitate the student with the skills and knowledge leading to enhanced career opportunities in industry, commerce, education, finance and research.

B.Sc. (H) Mathematics 2022 - 2023 SEMESTER I

		L	T	P	C
21MABS101	Modern Algebra	5	1	0	6
	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 able to:

CLO1: Recall the concepts of groups, rings and fields.

CLO2: Explain the notions of homomorphism and isomorphism in groups, rings, and fields.

CLO3: Develop a quotient groups and rings.

CLO4: Classify polynomial rings.

CLO5: Defend unique factorization domain.

		L	T	P	C
21MABS102	Calculus	5	1	0	6
	Prerequisite				
	Differentiation & Integration				

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: Demonstrate the consequences of the intermediate value theorem for continuous functions.

CLO3: Evaluate 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: Compile the area and volume of solid of revolution.

SEMESTER II

		L	T	P	C
21MABS201	Linear Algebra and Matrices	5	1	0	6
	Prerequisite				
	Modern 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: Know the concepts of vector space.

CLO2: Understand the notions of linear transformation.

CLO3: Determine basis and dimension of a vector space.

CLO4: Demonstrate characteristic polynomial.

CLO5: Compile the characteristic roots of a square matrix.

		L	T	P	C
21MABS202	Ordinary Differential Equations	5	1	0	6
	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: Distinguish between linear, nonlinear, partial and ordinary differential equations.

CLO2: Illustrate a homogeneous differential equation and the exact differential equation.

CLO3: Modify a linear differential equation by use of an integrating factor.

CLO4: Demonstrate basic application problems described by second order linear differential equations with constant coefficients.

CLO5: Compile the simultaneous equations.

SEMESTER III

		L	T	P	C
21MABS301	Mechanics	5	1	0	6
	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: 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: Demonstrate common catenary, Centre of gravity.

CLO5: Formulate forces in three dimensions.

		L	T	P	C
21MABS302	Theory of Equations	5	1	0	6
	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: Analyze and explain the notion of polynomials and equations.

CLO2: Know about the concept of symmetric functions.

CLO3: Construction and Classification of the algebraic equations.

CLO4: Illustrate roots of equations.

CLO5: Compile the Newton's theorem and Strums theorem

		L	T	P	C
21MABS303	Multivariate Calculus	5	1	0	6
	Prerequisite				
	Calculus				

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 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.

Compile the surfaces in plane and space.

SEMESTER IV

		L	T	P	C
22MABS401	Complex Analysis	5	1	0	6
	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: Know the significance of differentiability of complex functions.

CLO2: Understand the notions of contour integrals.

CLO3: Demonstrate Cauchy-Riemann equations.

CLO4: Explain Cauchy-Goursat theorem.

CLO5: Compile the Cauchy integral formula and Cauchy Residue theorem.

		L	T	P	C
21MABS402	Partial Differential Equations	5	1	0	6
	Prerequisite				
	Ordinary Differential Equations				

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: Compile methods of solving higher-order linear differential equations.

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

CLO5:

		L	T	P	C
21MABS403	Analysis I	5	1	0	6
	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: Know the concepts of bounded, convergent, divergent, Cauchy and monotonic sequences.

CLO2: Understand the notions of limit superior, limit inferior, and the limit of a bounded sequence.

CLO3: Construction of a sequence in terms of functions from \mathbb{N} to a subset of real line.

CLO4: Demonstrate many properties of the real line Understand.

CLO5: Compile the epsilon-delta approach.

SEMESTER V

		L	T	P	C
21MABS501	Numerical Methods	5	1	0	6
	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: 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: Fluent with interpolation.

CLO4: Compile the numerical roots of equations by different methods.

Construct of computational method that is suitable for various problems.

		L	T	P	C
21MABS502	Analysis II	5	1	0	6
	Prerequisite				
	Analysis I				

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 notions of Riemann integral and improper integral.

CLO2: Construct of Sequences and series of functions.

CLO3: Know the concepts Functions of bounded variation.

CLO4: Demonstrate Comparison tests.

CLO5: Compile the Abel's and Dirichlet's tests.

SEMESTER VI

		L	T	P	C
21MABS601	Metric Spaces	5	1	0	6
	Prerequisite				
	Analysis I				

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 basic concepts of metric spaces.

CLO2: Correlate these concepts to their counter parts in real analysis.

CLO3: Differentiate the abstractness of the concepts such as open balls, closed balls.

CLO5:

CLO4: Construction of compactness, connectedness etc.

CLO5: Compile the compact spaces.

		L	T	P	C
21MABS602	Vector Analysis	5	1	0	6
	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: 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: Construct of gradient, divergence and curl of a vector field and prove identities.

CLO4: Demonstrate irrotational and solenoidal vector fields.

CLO5: Compile the various integral theorems.

DISCIPLINE SPECIFIC ELECTIVE-I

		L	T	P	C
21MABS503	Applications of Algebra	5	1	0	6
	Prerequisite				
	Modern Algebra and 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: Understand about balanced incomplete block designs (BIBD).

CLO2: Know linear codes, Hamming Codes, decoding and cyclic codes.

CLO3: Describe symmetric groups.

CLO4: Examine Least squares methods, approximate solutions of system of linear equations.

Demonstrate LDU factorization and apply the row reduction algorithm and projection algorithms.

		L	T	P	C
21MABS504	Integral Transforms	5	1	0	6
	Prerequisite				
	Ordinary Differential Equations & Partial Differential Equations				

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 about Laplace-Integral transform.

CLO2: Apply Laplace-Integral transform.

CLO3: Describe Dirichlet's conditions, Parseval's identity.

CLO4: Demonstrate differential Equations using Fourier Transforms.

CLO5: Understanding about relation between Fourier Transforms and Fourier series.

		L	T	P	C
21MABS505	Econometrics	5	1	0	6
	Prerequisite				
	Statistics				

CLO5:**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 normal distribution and estimation of parameters.

CLO2: Compile the concept of testing of hypothesis.

CLO3: Study about estimation of parameters.

CLO4: Demonstrate correlation analysis.

CLO5: Examine errors analysis.

DISCIPLINE SPECIFIC ELECTIVE-II

		L	T	P	C
21MABS506	Operations Research I	5	1	0	6
	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: Describe 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: Analyze different types of transportation and assignment problems

		L	T	P	C
21MABS507	Mathematical Ecology	5	1	0	6

	Prerequisite				
	Modeling & Differential Equations				

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 work with excel environment.

CLO2: Illustrate simple mathematical model problems.

CLO3: Analyze the model and simulations of models.

CLO4: Demonstrate linear and nonlinear predator for Epidemics.

CLO5: Compile the simulation of gender-structured models.

		L	T	P	C
21MABS508	Industrial Mathematics	5	1	0	6
	Prerequisite				
	Arithmetic				

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 medical imaging and inverse problems.

CLO2: Describe the calculus and matrices.

CLO3: Study the geological anomalies in Earth's interior.

CLO4: Demonstrate CT scan and random transform.

CLO5: Examine the X-ray behavior, Beers law and random transform technique.

DISCIPLINE SPECIFIC ELECTIVE-III

		L	T	P	C
21MABS603	Basics of MATLAB	5	0	0	5
	Prerequisite				
	Basic of Programming & Matrices				

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 software for Lab Experimentation.

CLO2: Describe the basic mathematical problems in MATLAB.

CLO3: Design and conduct experiments.

CLO4: Demonstrate MATLAB basics command.

CLO5: Illustrate the software in the plotting of graph.

		L	T	P	C
21MABS653	Basics of MATLAB Lab	0	0	2	1
	Prerequisite				
	Basic of Programming & Matrices				

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 software for Lab Experimentation.

CLO2: Describe the basic mathematical problems in MATLAB.

CLO3: Design and conduct experiments.

CLO4: Demonstrate MATABL basics command.

CLO5: Illustrate the software in the plotting of graph

		L	T	P	C
21MABS604	Topology	5	1	0	6
	Prerequisite				
	Analysis				

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: Describe the connected property of topological space.

CLO3: Compile compact topological space.

CLO4: Demonstrate separation axiom of topological space.

CLO5: Illustrate connected and homeomorphism on topological space.

		L	T	P	C
21MABS605	Bio-Mathematics	5	1	0	6

	Prerequisite				
	Modeling & Differential Equations				

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 concept of mathematical modeling in biology.

CLO2: Describe mathematical models.

CLO3: Study the optimal exploitation models, models in genetics.

CLO4: Demonstrate age structure models.

CLO5: Illustrate numerical solution of the models and its graphical representations.

DISCIPLINE SPECIFIC ELECTIVE-IV

		L	T	P	C
22MABS606	Discrete Mathematics	5	1	0	6
	Prerequisite				
	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: Understand mathematical logic.

CLO2: Describe operational property of set theory.

CLO3: Apply the recurrence relations and generating functions.

CLO4: Illustrate shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.

CLO5: Demonstrate Boolean algebra.

		L	T	P	C
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21MABS607	Fuzzy Set Theory	5	1	0	6
	Prerequisite				
	Set Theory & Analysis				

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 fuzzy sets and fuzzy logic.

CLO2: Describe lattices and graph.

CLO3: Apply the fuzzy numbers and arithmetic operations.

CLO4: Demonstrate Logical connectives and fuzzy graphs.

CLO5: Illustrate logical connectives for fuzzy logic.

		L	T	P	C
21MABS608	Differential Geometry	5	1	0	6
	Prerequisite				
	Calculus				

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 theory of space curves.

CLO2: Describe Euler's theorem and theory of minimal surface.

CLO3: Apply the Curl, Divergence and Laplacian operators in tensor form.

CLO4: Demonstrate geodesics.

CLO5: Illustrate tensors contraction.

OPEN ELECTIVES - I

		L	T	P	C
21OEFT001	Food Processing and Preservation	3	0	0	3

	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 the general methods of food processing and preservation.

CLO2: Explain changes which take place during different methods of processing and preservation.

CLO3: Understand the requirement for different methods of processing and preservation.

CLO4: Compile upcoming trends in food industry.

Quantum Mechanics	
Course Code: 21OEPH001	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	Course Type: Open Elective
Prerequisite: Basic knowledge about Differential equation	

COURSE LEARNING OUTCOMES (CLO)

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

CLO1: Understand the dual nature of light and matter.

CLO2: The details of quantum properties of micro size particles and quantum descriptions. of its physical properties.

CLO3: Fluent with quantum mechanical approach to solve simple 1D problem.

CLO4: Well versed with quantum treatment of electric and magnetic field effects on the atomic spectra.

Physical Chemistry-I	
Course Code:21OECY001	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P: 3 0 0	Course Type: Open Elective
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: Calculate the heat flow into and work done by a system and how that is constrained by the first law of thermodynamics.

CLO2: Explain the behavior of ideal and real gases.

CLO3: Describe various radioactive decay process, decay kinetics and to measure the radioactivity.

CLO4: Demonstrate the symmetry elements and symmetry operation, lattice parameters using the X-ray diffraction pattern.

INTRODUCTORY MICROECONOMICS	
Course Code: 21GEES101	Continuous Evaluation: 50 Marks
Credits: 3	End Semester Examination: 50 Marks
L T P : 3 0 0	Course Category: Open/ Generic Elective
Prerequisite: NIL	

COURSE LEARNING OUTCOMES (CLO)

CLO1: able to understand and highlight basic economic problems of an economy and basic principles of microeconomic theory.

CLO2: put the theory learnt in daily-life situations

CLO3: understand forces of demand and supply.

CLO4: differentiate between different market structures.

OPEN ELECTIVES - II

		L	T	P	C
21OEFT002	Food Safety and Regulations	3	0	0	3
	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 food safety and types of hazards.

CLO2: Apply concepts of Food Safety Management to real life situations.

CLO3: Comprehend the need for well-defined quality management system.

CLO4: Understand the importance of food laws and regulations

		L	T	P	C
21OEPH002	Thermal Physics and Statistical Mechanics	3	0	0	3
	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: Compile the theory of equipartition to relate the structure of the molecules to the measured heat capacity.

CLO2: Utilize the kinetic theory of gases and calculate properties of gases including the heat capacity and mean free path.

CLO3: Understand Thermodynamics - entropy and relate this to the second law of thermodynamics and calculate entropy changes.

CLO4: Compile and link the microscopic view of a system to its macroscopic state variables be able to derive and use Maxwell's equations.

		L	T	P	C
21OECY002	Inorganic Chemistry	3	0	0	3
	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 the atomic structure and shape of orbital's.

CLO2: Explain the concept of concept of ionic bonding.

CLO3: Explain the concept of concept of covalent bonding

CLO4: Demonstrate the structure and properties of important coordination compounds.

STATISTICAL SIMULATION TECHNIQUES	
Course Code: 21OEMA022	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 2 0 2	Course Type: Open elective 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: Use of simulation to understand the behavior of real-world systems.

CLO2: Ability to generate Pseudo-random numbers by the different methods.

CLO3: Random variable generation from theoretical distributions.

CLO4: Use of Monte Carlo methods and regenerative simulation.

ENVIRONMENTAL ECONOMICS	
Course Code: 21GEES102	Continuous Evaluation: 50 Marks
Credits: 3	End Semester Examination: 50 Marks
L T P : 3 0 0	Course Category: Open/ Generic Elective
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: able to understand and demonstrate basic concepts and their relevance

CLO2: acquire knowledge of valuation of environment

CLO3: discuss key environmental problems

CLO4: familiarise with sustainable development and international agreements

OPEN ELECTIVES - III

		L	T	P	C
21OEFT003	Fundamentals of Food Chemistry	3	0	0	3
	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 and describe the general chemical structures of the major components of foods.

CLO2: Explain observed physical properties and reactivity of major food components.

CLO3: Examine how processing conditions are likely to change the reactivity of food components.

CLO4: Predict how changes in overall composition are likely to change the reactivity of individual food.

		L	T	P	C
21OEPH003	Waves and Optics	3	0	0	3
	Prerequisite				
	Basic knowledge about Differential equation				

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 fundamental principles underlying wave phenomena.

CLO2: Examine the concepts of interference and diffraction.

CLO3: Compile the knowledge of linear, circular polarization and various devices based on phenomenon of polarization.

CLO4: Illustrate the basic principles of waves and optics.

		L	T	P	C
21OECY003	Physical Chemistry-II	3	0	0	3

	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: Apply the postulates of quantum chemistry and to simple system.

CLO2: Describe the applications of rotational spectroscopy.

CLO3: Explain vibrational energy and transitions in molecules.

CLO4: Demonstrate the structure and properties of compounds using electronic spectroscopy.

INTRODUCTORY MACROECONOMICS	
Course Code: 21GEES201	Continuous Evaluation: 50 Marks
Credits: 3	End Semester Examination: 50 Marks
L T P : 3 0 0	Course Category: Open/ Generic Elective
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 basic concepts of Macroeconomics

CLO2: acquire knowledge of how an economy works

CLO3: develop the understanding about money and inflation **CLO4:**

describe the outline of balance of payments

OPEN ELECTIVES - IV

		L	T	P	C
21OEPH004	Solid State Physics	3	0	0	3
	Prerequisite				
	Basic knowledge on crystallography				

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 various crystal structures and their crystal symmetries.

CLO2: Describe the concept of Bragg's X-ray diffraction

CLO3: Compile the up-to-date knowledge of the basic ideas, and outstanding problems in solid state materials

CLO4: Understand the band theory and their application in electronic conduction.

		L	T	P	C
21OECY004	Analytical Chemistry	3	0	0	3
	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: Apply the data analysis in qualitative and quantitative estimation.

CLO2: Explain the principle and applications of thermal methods of analysis.

CLO3: Illustrate principle and applications of different electroanalytical methods. **CLO4:** Demonstrate various techniques in separation of different compounds.

PROGRAMMING in C++	
Course Code:21OEMA004	Internal Examination: 40
Credits: 3	External Examination: 60
L T P : 2 0 2	Course Category: Open elective
Prerequisite:	

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.

PUBLIC ECONOMICS	
Course Code: 21GEES301	Continuous Evaluation: 50 Marks
Credits: 3	End Semester Examination: 50 Marks
L T P : 3 0 0	Course Category: Open/ Generic Elective
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: able to understand and demonstrate basic concepts of public economic theories and their relevance

CLO2: build an understanding of externalities and their solution

CLO3: learn about taxation and public finance

CLO4: differentiate between different types of deficits

OPEN ELECTIVE -V

		L	T	P	C
21OECS005	Operating Systems	1	0	0	1
	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: Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

CLO2: Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.

CLO3: Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.

CLO4: Examine and categories various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.

		L	T	P	C
21OECS151	Operating Systems Lab	0	0	2	1
	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: Construct algorithms.

CLO2: Design algorithms and page replacement algorithms.

CLO3: Illustrate memory management schemes, Thread and synchronization.

CLO4: Develop program on replacement policy using LRU and FIFO.

		L	T	P	C
21OEST006	Statistical Methods and Probability	3	0	0	3
	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 different types of data

CLO2: Manage data and make charts, graphs and tables for a specific data

CLO3: Understand the concept of probability and make it apply on real problems

CLO4: Apply Baye's theorem on real life situations, discrete and continuous distributions

INDIAN ECONOMY	
Course Code: 21GEES401	Continuous Evaluation: 50 Marks
Credits: 3	End Semester Examination: 50 Marks
L T P : 3 0 0	Course Category: Open/ Generic Elective
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: review major demographic indicators

CLO2: comprehend the concept of inequality

CLO3: analyse agriculture sector

UNIVERSITY OPEN ELETIVE COURSES

SEMESTER II

Indian Constitution and Polity	
Course Code: 21GE204A	Continuous Evaluation: 40 Marks
Credits: 3	End Semester Examination: 60 Marks
L T P : 3 0 0	Course Category: Open/ Generic Elective
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: Identify and explore basic concepts in the Constitution and understand their applicability and scope and the importance of the role of judiciary in ensuring checks and balances.

CLO2: Differentiate different aspects of Indian Legal System and its related bodies

CLO3: To appreciate the critical Interface between fundamental Rights and directive principles of state policy and apply the rationale to emerging issues and challenges.

CLO4: Know about the enforcement remedies available under the Constitution of India **CLO5:** Know about the RTI Act, 2005 and Information Technology Act, 2000.

CLO6: To apply the very dynamics of IP Law to the individuals, MNC's and other possible stakeholders.

SEMESTER III

ABILITY ENHANCEMENT COMPULSORY COURSES

		L	T	P	C
21AEEN101	Professional English	4	0	0	4
	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: Communicate in standard English – written & spoken

CLO2: Analyze texts on various parameters expected/demanded during different situations and circumstances

CLO3: Conduct basic research on a topic (pertaining to their discipline/workplace)

CLO4: Illustrate basic/preliminary research documents, official documents and deliver presentations on a given topic.

		L	T	P	C
21ESUG201	Environmental studies	4	0	0	4
	Prerequisite				
	Basic understanding about earth and Environment				

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: Develop an awareness about our environment and elicit collective response for its protection.

CLO2: Know and analyses the physical, chemical, and biological components of the earth's systems and their function.

CLO3: Understand cause of Environmental pollution and prevention.

CLO4: Examine Natural resources, Climate change and Sustainable development.

SKILL ENHANCEMENT COURSES

		L	T	P	C
21CS151A	IT Skills	0	0	4	2
	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 basic fundamental components of computers including the working of internet.

CLO2: Analyze working of MS-Word including creating and modifying the text documents and its conversion into different other formats like pdf., etc.

CLO3: Apply different formulas in the Excel sheets to solve complex business problems.

CLO4: Create a good interactive presentation using MS-PowerPoint.

CLO5: Enhance the data analytics practices executed in the business world.

CLO6: Identify the characteristics of datasets and compare the trivial data and big data for various applications.

CLO7: 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: Analyze the factors that influenced the advancements of AI in recent year.

		L	T	P	C
21MABS251	LaTeX	0	0	2	1
	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: Explain different types of documents.

CLO2: Organize documents into different sections, subsections, etc.

CLO3: Formulate pages (margins, header, footer, orientation), formatting text.

CLO4: Develop complex mathematical formulae, Include tables and images.

CLO5: Describe Cross-referencing, bibliography, and Indexing, read error messages as and when required, create presentations using Beamer.

		L	T	P	C
21MABS651	R Programming	1	0	2	2
	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 the basics of Fundamentals of R.

CLO2: Understands the loading, retrieval techniques of data.

CLO3: Illustrate how data is analyzed and visualized using statistic functions.

CLO4: Compile the collection, compilation of data.

CLO5: Develop programming for problem solving.

SOFT SKILLS TRAINING MODULES/COURSES STRUCTURE SEMESTER WISE IN SCIENCE & HUMANITIES

SEMESTER – II

		L	T	P	C
21SS251	EFFECTIVE COMMUNICATION SKILLS	0	0	2	1
	Prerequisite				
	Basic English				

Course Learning Outcomes (CLO): -

After the completion of the training, the students would be able to:

CLO1: Communicate effectively and interact with people with confidence.

CLO2: Demonstrate and differentiate between various forms of communication.

CLO3: Apply effective communication skills confidently which a student needs to get ahead in job and life.

SEMESTER -III

		L	T	P	C
21SS352	TEAMWORK & INTERPERSONAL SKILLS	0	0	2	1
	Prerequisite				

	Nil				
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Course Learning Outcomes (CLO): -

After the completion of the training, the students would be able to:

CLO1: Develop confident working in a team and leading it as well.

CLO2: Analyze 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.

CLO3: Anticipate the situation and get benefitted from Emotional Quotient in building stronger professional relationships and achieving career and personal goals.

CLO4: Illustrate complex problems and effectively deal with it in the job due to Critical Thinking & Problem-Solving Skills.

SEMESTER - IV

		L	T	P	C
21SS453	PRESENTATION & SPEAKING SKILLS	0	0	2	1
	Prerequisite				
	Nil				

Course Learning Outcomes (CLO): -

After the completion of the training, the students would be able to:

CLO1: Develop confidence in presenting himself in front of audience.

CLO2: Illustrate professional in his approach towards work culture.

CLO3: Enhance the level communication skills while interacting with others.

SEMESTER - V

		L	T	P	C
21SS554	PROFESSIONAL WRITING SKILLS & INTERPERSONAL SKILLS: STRATEGIES	0	0	2	1
	Prerequisite				
	Nil				

Course Learning Outcomes (CLO): -

After the completion of the training, the students would be able to:

CLO1: Understand the importance of professional writing required in workplace.

CLO2: Explore different formats in resume, cover letters & other business-related letters.

CLO3: Develop knowledge, skills and understanding people in-group and individually.

CLO4: Apply communication strategies either in-group or one on one basis and will be confident to lead the discussion among them.

		L	T	P	C
21MABS571	LIVE PROJECTS & INDUSTRY VISITS	0	0	0	1
	Prerequisite				
	Nil				

LIVE PROJECT OUTCOMES

On completion of the live project(s), students would be able to:

CLO1: Prepare strong foundation knowledge of domain area.

CLO2: Manage a challenge and place better career development scenario in professional life.

CLO3: Develop strong boost for experienced to take their career into next stage.

CLO4: Organize various activities during completion of live projects it shows a better stand and technical expertise in domain area.

		L	T	P	C
21MABS472	SUMMER INTERNSHIP	0	0	0	4
	Prerequisite				
	Nil				

COURSE LEARNING OUTCOMES

On completion of course, students would be able to:

CLO1: Demonstrate various aspects of theory as well as practical.

CLO2: Build and expand network of professional relationships and contacts.

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

CLO4: Apply knowledge in their domain area.

M.Sc. – Mathematics (2022-23)

PROGRAMME LEARNING OUTCOME (PLOs)

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

PLO1: Apply knowledge of Mathematics, in all the fields of learning, including higher research and its extensions.

PLO2: Carry out development work as well as take up challenges in the emerging areas of the industry.

PLO3: Demonstrate competence in using mathematical and computational skills to model, formulate and solve real life applications.

PLO4: Crack lectureship and fellowship exams approved by UGC like CSIR – NET and SET/ISRO/DRDO.

PLO5: Enhance the ability to establish advanced independent critical enquiry and analysis.

PROGRAMME SPECIFIC OBJECTIVES (PSOs)

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

PSO1: To provide knowledge of a wide range of mathematical techniques and application of mathematical methods/tools in other scientific and engineering domains.

PSO2: To provide students with advanced mathematical and computational skills that prepares them to pursue higher studies and conduct research.

PSO3: To motivate the students for research studies in mathematics and related fields.

PSO4: To provide students with a knowledge, abilities and insight in Mathematics and computational techniques so that they are able to work as mathematical professional.

PSO5: To provide students with knowledge and capability in formulating and analysis of mathematical models of real-life applications.

M.Sc. 2022-23 SEMESTER I

Course Code	Subject Name	L	T	P	C
22MAMS101	Abstract Algebra	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

CLO 1: Learn to construct and describe groups.

CLO 2: To describe the properties of groups and get familiar with important classes of groups.

CLO 3: Apply Sylow's theorems to describe the structure of some finite groups.

CLO 4: Become familiar with rings, integral domain and their arithmetic.

CLO 5: Understand the concept of fields.

Course Code	Subject Name	L	T	P	C
21MAMS102	Real Analysis	3	1	0	4
CORE	Pre-requisite				

	Co-requisite
	Designed by Mathematics Department

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS103	Complex Analysis	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS104	Ordinary Differential Equations	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

SEMESTER II

Course Code	Subject Name	L	T	P	C
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21MAMS201	Linear Algebra	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completing this course, students will 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.

Course Code	Subject Name	L	T	P	C
21MAMS202	Numerical Analysis	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS203	Discrete Mathematics	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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

Course Code	Subject Name	L	T	P	C
21MAMS204	Integral Equations and Calculus of Variations	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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

Course Code	Subject Name	L	T	P	C
21MAMS301	Topology	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

After completion of the course, the student will be able to understand:

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 , $T_{3\frac{1}{2}}$, T_4 .

Course Code	Subject Name	L	T	P	C
21MAMS302	Partial Differential Equations	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

After completion of this course, the student will be able to:

CLO1: Able to understand the partial differential equation problem

CLO2: Fluent with linear and no-linear systems

CLO3: Able to solve the first-order linear and non-linear PDE's by using transform methods and other methods

CLO4: Able to determine the solutions of linear PDE's of second and higher order with constant coefficients

CLO5: Get an understanding of Laplace transforms and Legendere transform.

Course Code	Subject Name	L	T	P	C
21MAMS303	Operations Research	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

After completion of this course, the student will 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 and assignment 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 non-linear programming problems using Lagrange multiplier and using Kuhn-Tucker- conditions

SEMESTER – IV

Course Code	Subject Name	L	T	P	C
21MAMS401	Functional Analysis	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

After completion of the course, the student will be able to :

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 Category.

CLO3: Produce examples and counterexamples illustrating the mathematical concepts presented in the course.

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

CLO5: Knowledge of open mapping and closed theorem.

Course Code	Subject Name	L	T	P	C
21MAMS402	Measure Theory and Integration	3	1	0	4
CORE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME :

Upon completion of this course, the student will be able to:

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 theorem.

Department Elective -I

Course Code	Subject Name	L	T	P	C
21MAMS105	Transform Techniques with Applications	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

CLO1: Know the use of Laplace transform in system modeling, digital signal processing, process control, solving Boundary Value Problems.

CLO2: Comprehend the versatility of the Fourier transform in communication theory and signal analysis, image processing and filters, data processing and analysis, solving partial differential equations for problems on gravity.

CLO3: Use Z-transform in the characterization of Linear Time Invariant system in development of scientific simulation algorithms.

CLO4: Familiar with Hankel transform and its applications.

CLO5: Solve problems of algebraic, differential and integral equations using the transform techniques.

Course Code	Subject Name	L	T	P	C
21MAMS107	Financial Mathematics	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS106	Computer Programming using MATLAB	3	0	2	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME: Upon completing this course, students will 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.

Department Elective – II

Course Code	Subject Name	L	T	P	C
21MAMS205	Probability & Statistics	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

CLO1: Organize, present and interpret statistical data, both numerically and graphically and use various methods to compute the probabilities of events.

CLO2: Analyse and interpret statistical data using appropriate probability distributions.

CLO3: Understand the transformation of random variables, central limit theorem, and its application.

CLO4: Construct and interpret confidence intervals to estimate means, standard deviations and proportions of populations.

CLO5: Perform parameter testing techniques, including single and multi-sample tests for means, standard deviations and proportions.

Course Code	Subject Name	L	T	P	C
22MAMS208	Python Programming	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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 applications in different scenarios.

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

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

Course Code	Subject Name	L	T	P	C
21MAMS207	Number Theory	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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 congruences of various types and use the theory of congruences 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: Formulate and prove conjectures about numeric patterns, and produce rigorous arguments centred on the material of number theory, most notably in the use of Mathematical Induction and/or the Well Ordering Principle in the proof of theorems.

Department Elective - III

Course Code	Subject Name	L	T	P	C
21MAMS304	Fluid Dynamics	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

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 velocity and 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 analyze 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.

Course Code	Subject Name	L	T	P	C
21MAMS305	Computing with C++	3	1	0	4

DE	Pre-requisite
	Co-requisite
	Designed by Mathematics Department

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS306	Statistical Inference	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

CLO1: Able to estimate the optimality.

CLO2: Able to apply Neyman Pearson theory of testing and closely related theory of point estimation and confidence sets in real life applications.

CLO3: Get an understanding of order statistics and their distributions and apply non-parametric tests according to the problem.

CLO4: Able to apply testing of equality of two means and two variances of two univariate normal distributions, related confidence intervals.

CLO5: Get an understanding Run test, Median test and Mann Whitney-U-test .

Department Elective – IV

Course Code	Subject Name	L	T	P	C
21MAMS307	Mechanics	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

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.

Course Code	Subject Name	L	T	P	C
21MAMS308	Mathematical Programming	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

CLO1: Get an understanding of convex sets and functions and application of Kuhn-Tucker conditions of 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.

Course Code	Subject Name	L	T	P	C
21MAMS310	Data Structures using C	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

CLO1: Analyze 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 analyze 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 Elective - V

Course Code	Subject Name	L	T	P	C
21MAMS403	Modeling and Simulation	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME: Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS404	Algebraic Topology	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will be able to:

CLO1: Graps 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 E_n

CLO5: Classify the surfaces and covering spaces

Course Code	Subject Name	L	T	P	C
21MAMS405	Theory of Elasticity	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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: Analyze various stress function

CLO5: Identify and apply various Waves

Department Specific Elective – VI

Course Code	Subject Name	L	T	P	C
21MAMS406	Differential Geometry	3	1	0	4
DE	Pre-requisite				

	Co-requisite
	Designed by Mathematics Department

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS407	Stochastic Processes	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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.

Course Code	Subject Name	L	T	P	C
21MAMS408	Computing with R	3	1	0	4
DE	Pre-requisite				
	Co-requisite				
	Designed by Mathematics Department				

LEARNING OUTCOME:

Upon completion of this course, the student will 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.