

**Department of Mathematics**  
**Govt. General Degree College, Manbazar II**

<b>Mathematics (Honours)</b>			
<b>SEM-I</b>			
<b>Course code</b>	<b>Course title</b>	<b>Unit/ Topic</b>	<b>Course outcomes (CO)</b>
<b>BMTMCCHT-101</b>	<b>Calculus &amp; Analytical Geometry (2D)</b>	<b>Unit 1: Differential Calculus</b>	CO1: Familiarize with Higher Order Derivatives & Leibnitz Rule for Successive Differentiation with its applications CO2: Understanding of Intermediate Forms & L'Hospital's Rule CO3: Understanding the basic ideas Partial Derivatives and applications of Euler's Theorem CO4: Familiarize with applications of Differential Calculus
		<b>Unit 2: Integral Calculus</b>	CO1: Familiarize with Reduction Formulae in Integration and applications of Integral Calculus
		<b>Unit 3: Analytical Geometry (2D)</b>	CO1: Understanding of Transformation of Axes and its uses for the reduction of General Equation of Second Degree to Canonical form CO2: Understanding geometry of two-dimensional plane figures CO3: Familiarize with Polar Co-ordinate system and polar equation of line, circle, conics & tangent and normal to conics
<b>BMTMCCHT-102</b>	<b>ALGEBRA-I</b>	<b>Unit -1: Classical Algebra</b>	CO1: Understanding of De-Moivre's theorem and its application CO2: Understanding of Rolle's theorem and its application CO3: Learn methods to solve equations, transformed equations, cubic, bi-quadratic and reciprocal equations CO4: Familiarize with A.M, G.M, &

			H.M and useful inequalities CO5: Familiarize with Simple Continued Fractions and its convergent
		<b>Unit -2: Abstract Algebra &amp; Number Theory</b>	CO1: Concept of Mappings, Equivalence Relation and Lattice  CO2: Concept of Mathematical Induction & Fundamental Theorem of Arithmetic CO3: Understanding of Euclid's Algorithm, GCD, LCM CO4: Understand the definitions of congruence, power of congruence and related theorems CO5: Familiarize with Eulers $\phi$ function- $\phi(n)$ . Mobius $\mu$ -function, relation between $\phi$ function and $\mu$ function. Diophantine equations of the form $ax+by = c$ , $a, b, c$ integers
<b>SEM-II</b>			
<b>BMTMCCHT-201</b>	<b>REAL ANALYSIS-I</b>	<b>Unit 1: REAL ANALYSIS I</b>	CO1: Understand algebraic & order properties of Real numbers and completeness of Real numbers CO2: Idea of countable and uncountable sets CO3: Concept of limit points, open sets and closed sets CO4: Concept of Sequence and Series of Real numbers and their convergences
<b>BMTMCCHT-202</b>	<b>ORDINARY DIFFERENTIAL EQUATIONS &amp; LINEAR ALGEBRA-I</b>	<b>Unit 1: ODE</b>	CO1: Familiarize with First order linear Ordinary Differential Equations and their solution techniques CO2: Identification and solution techniques of First order non-linear Ordinary Differential Equations CO3: Understanding of applications of First order Ordinary Differential Equations, Orthogonal Trajectories CO4: Familiarize with different solution techniques of Higher order linear Ordinary Differential Equations with constant co-efficients and variable co-efficients CO5: Understanding simultaneous

			linear Ordinary Differential Equations and Total Differential equations
		<b>Unit 2: Linear Algebra</b>	CO1: Concept of vector space, Basis and Dimension of a finite dimensional vector space CO7: Acquainted with the Existence of solutions of system of Linear Equations and their solution techniques
<b>SEM III</b>			
<b>BMTMCCHT-301</b>	<b>REAL ANALYSIS-II</b>	<b>Unit1: Real Analysis II</b>	CO1: Concept of limit, continuity and differentiability of functions of one and several variables CO2: Mean value theorems and their applications CO3: Finding series expansion of various functions CO4: Finding extremum of functions including the method of Lagrange's multipliers CO5: Idea of double and triple integration to find area and volume
<b>BMTMCCHT-302</b>	<b>ABSTRACT ALGEBRA-II</b>	<b>Unit 1: Abstract Algebra II</b>	CO1: Concept of Groups, Subgroups, Cyclic groups, Permutations groups, Centralizer, Normalizer CO2: Learn Lagrange's theorem and it's consequences including Fermat's little theorem CO3: Understand the concept of Rings and Fields
<b>BMTMCCHT-303</b>	<b>ANALYTICAL GEOMETRY (3D) &amp; VECTOR ANALYSIS</b>	<b>Unit 1: 3D Geometry</b>	CO1: Understanding the concept of Three-dimensional space and it's geometry CO2: Understanding the geometrical characteristics of Sphere, Cone, Cylinder and the Generators of the Quadrics CO3: Concept of Central Conicoids like Ellipsoid, Hyperboloids of One or Two Sheets CO4: Familiarize with Generating lines with Ruled and Skew Surfaces CO5: Understanding the concepts of Transformation of co-ordinate axes in three dimensions and reduction of Second degree equations to its canonical form

		<b>Unit 2: Vector Analysis</b>	<p>CO1: Understanding the Product of three or more vectors</p> <p>CO2: Concept of Vector Calculus, Differentiation and Integration of vector-valued functions</p> <p>CO3: Idea of Gradient, Divergence &amp; Curl of Vectors and their properties</p> <p>CO4: Understanding of Line integral. Surface integral and Volume integral of vector functions; applications of Green's theorem and Stokes' theorem</p>
<b>BMTMSEHT-305 (SEC-I)</b>	<b>LOGIC &amp; SETS</b>	<b>Unit 1: Logic &amp; Sets</b>	<p>CO1: Concept of propositions and truth table</p> <p>CO2: Precedence of logical operators and propositional equivalency</p> <p>CO3: Concept of predicates and quantifiers</p> <p>CO4: Elementary idea of sets and Relations with their applications</p>
<b>SEM IV</b>			
<b>BMTMCCHT-401</b>	<b>DYNAMICS OF PARTICLES</b>	<b>Unit 1: Dynamics of Particle</b>	<p>CO1: Understanding the concept of motion of a particle in a straight line in resisting and non-resisting medium</p> <p>CO2: Familiarize with Simple Harmonic Motion and its applications</p> <p>CO3: Understanding the concept of Impulsive Forces and its application in collision of elastic bodies</p> <p>CO4: Understanding the concept of motion of a particle in two dimensional Cartesian plane</p> <p>CO5: Understanding the concept of motion of a particle in two dimensional polar plane and its application in the study of Central Orbits and Planetary Motion</p> <p>CO6: Conceptualize the idea of Constrained Motion</p>
<b>BMTMCCHT-402</b>	<b>PARTIAL DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORM &amp; TENSOR ANALYSIS</b>	<b>Unit 1: PDE</b>	<p>CO1 : Understanding the basic concepts of Partial Differential Equations</p> <p>CO2: Familiarize with Formation and Solution techniques of linear and non-linear Partial Differential Equations</p>

		<b>Unit2: Laplace Transform</b>	<p>CO1: Understanding the basic concepts of Laplace Transform and the idea Laplace Transform of Some Elementary Functions &amp; Derivatives</p> <p>CO2: Understanding the Convolution Theorem &amp; Inverse of Laplace Transform and application of Laplace Transform in Ordinary Differential Equations</p>
		<b>Unit 3: Tensor Analysis</b>	<p>CO1: Understanding the Tensor as generalized concept of Vector in <math>E_3</math> and <math>E_n</math></p> <p>CO2: Understanding Covariant, Contravariant and Mixed Tensors, Algebra of tensors, Contraction, Outer and Inner product, Quotient law in Tensors</p> <p>CO3: Familiarize with Metric tensor of Riemannian Space, Christoffel Symbols and covariant differentiation of tensors</p>
<b>BMTMCCHT-403</b>	<b>REAL ANALYSIS-III</b>	<b>Unit 1: Real Analysis III</b>	<p>CO1: Acquire in-depth knowledge of Riemann and Improper Integration</p> <p>CO2: Understanding of the Convergence of Beta and Gamma functions</p> <p>CO3: Concept of sequence and series of functions and their convergences</p> <p>CO4: Learn Fourier series and Fourier expansion of functions</p> <p>CO5: Understand the Power series &amp; finding radius and interval of convergence of power series</p>
<b>BMTMSEHT-405 (SEC-II)</b>	<b>GRAPH THEORY</b>	<b>Unit 1: Graph Theory</b>	<p>CO1: Concept and basic properties of Graphs</p> <p>CO2: Understanding of Eulerian and Hamiltonian Graphs</p> <p>CO3: Representation of Graph by matrix (Adjacency and incidence matrix)</p> <p>CO4: Understanding of Travelling Salesman Problem using Graphs</p>
<b>SEM V</b>			
<b>BMTMCCHT-501</b>	<b>ALGEBRA-III</b>	<b>Unit-1: Abstract Algebra</b>	<p>CO1: Understanding the concept of Quotient groups and Quotient Rings</p>

			CO2: Familiarize with Isomorphism Theorems of Groups and Rings
		<b>Unit-2: Linear Algebra</b>	CO1: Understanding the Linear Transformation and Matrix representation of a Linear Transformation CO2: Concept of Eigen values and Eigen vectors of a matrix and Diagonalization of Matrices of order 2 and 3 CO3: Understanding the concept of Elementary of Inner Product Spaces and Norms
<b>BMTMCCHT-502</b>	<b>METRIC SPACES &amp; COMPLEX ANALYSIS</b>	<b>Unit-1: Metric Spaces</b>	CO1: Idea of Metric Spaces with some standard examples CO2: Familiarize with Continuity and Homeomorphisms in Metric Spaces CO3: Detailed study of Compactness, Connectedness and Completeness of Metric Spaces
		<b>Unit-2: Complex Analysis</b>	CO1: Understanding the Stereographic projection of complex number and extended complex plane CO2: Understanding the Concept of Limit, Continuity and Differentiability of a complex function and Cauchy-Riemann equation CO3: Understanding the Concept of Conformal mappings and Bilinear transformations
<b>BMTMDSHT-1 (DSE-I)</b>	<b>LINEAR PROGRAMMING</b>	<b>Unit 1: Linear Programming</b>	CO1: Introduction of the Optimization Problems and Formation of Linear Programming Problem CO2: Familiarize with the basic theorems of LPP and concepts of Convex Sets, Convex Functions, Feasible and Basic Feasible Solutions of LPP CO3: Understanding the idea of Simplex Algorithm as a Solution technique of LPP and Duality Theory CO4: Understanding of Transportation and Assignment Problems with their solution techniques CO5: Introduction of the concept of Game Theory, Two-Person-Zero-Sum Game CO6: Familiarize with different solution techniques of Game

			Problems
<b>BMTMDSHT-2 (DSE-II)</b>	<b>MECHANICS-I</b>	<b>Unit 1: Mechanics-I</b>	<p>CO1: Concept and basics of Classical Dynamics, Inertial Frames, Galilean Transformation and its applications</p> <p>CO2: Understanding of the motion of System of Particles</p> <p>CO3: Understanding the Moments and Product of Inertia and M.I. and P.I. of some Plane Laminas and Rigid Bodies</p> <p>CO4: Understanding of Projection Dynamics, the Two-dimensional motion of Rigid Bodies</p>
<b>SEM VI</b>			
<b>BMTMCCHT-601</b>	<b>NUMERICAL METHODS &amp; COMPUTER PROGRAMMING</b>	<b>Unit-1: Numerical Methods</b>	<p>CO1: Understanding the concept of Convergence, Errors, Rounding-off, Truncation in Numerical methods</p> <p>CO2: Familiarize with Interpolation for equispaced and un-equispaced arguments</p> <p>CO3: Understanding different solution methods for finding root of algebraic and transcendental equations with their geometrical interpretations and convergence conditions</p> <p>CO4: Familiarize with solution methods of system of linear equations</p> <p>CO5: Concept of Numerical Integration, idea of Newton-Cotes' quadrature formula, Trapezoidal and Simpson's formula</p> <p>CO6: Understanding the concept of numerical methods for solving First Order Ordinary Differential Equations using Euler method and Runge-Kutta method of order 2 and 4</p>
		<b>Unit-2: Computer Programming</b>	<p>CO1: Familiarize with computer system, Hardware and Software of Computers</p> <p>CO2: To develop the idea of Binary number system and computer languages, ML, AL &amp; HLL</p>

			CO3: Introduction C programming language; its structure, operators, keywords and some simple programs using C language to solve numerical problems
<b>BMTMCCHS-602</b>	<b>COMPUTER AIDED NUMERICAL PRACTICAL</b>	<b>Unit 1: Computer Aided Numerical Practical</b>	CO1: Familiarize with hand-on experience of using computers for solving numerical problems CO2: Understand to write the programs using C language for solving interpolation problem, finding root of an equation, solving numerical integration and differential equations
<b>BMTMDSHT-4 (DSE-III)</b>	<b>PROBABILITY AND STATISTICS</b>	<b>Unit-1: Probability</b>	CO1: Acquire in depth knowledge of Probability, probability density function, probability distribution function, moment generating functions for discrete and continuous variables CO2: Understanding the joint cumulative distribution function, probability density function and expectations
		<b>Unit-2: Statistics</b>	CO1: To develop the concept of statistical population and random sample, sampling distribution sample mean with $\chi^2$ and $t$ distribution CO2: Familiarize with the concept of Testing of hypothesis based on $z$ , $\chi^2$ and $t$ distributions
<b>BMTMDSHT-5 (DSE-IV)</b>	<b>MECHANICS-II</b>	<b>Unit-1: Statics</b>	CO1: Familiarize with Statics, Reduction of forces in three dimensions and its resultant, concept of couple and Poinso't's central axis CO2: Understanding the concept of virtual work and its applications, Stable and unstable equilibrium and idea of equilibrium of heavy inextensible string
		<b>Unit-2: Elements of Continuum Mechanics &amp; Hydrostatics</b>	CO1: To develop the concept of continuum mechanics CO2: To develop the concept of equilibrium of fluids in a field of force, pressure and thrust on heavy fluids CO3: Familiarize with equation of state of perfect gas, isothermal

## Mathematics (Program)

### SEM-I

Course code	Course title	Unit/ Topic	Course outcomes
BMTMCCRT-101	<b>Calculus &amp; Analytical Geometry (2D)</b>	Unit 1: Differential Calculus	CO1: Familiarize with Higher Order Derivatives & Leibnitz Rule for Successive Differentiation with its applications CO2: Understanding of Intermediate Forms & L'Hospital's Rule CO3: Understanding the basic ideas Partial Derivatives and applications of Euler's Theorem CO4: Familiarize with applications of Differential Calculus
		Unit 2: Integral Calculus	CO1: Familiarize with Reduction Formulae in Integration and applications of Integral Calculus
		Unit 3: Analytical Geometry (2D)	CO1: Understanding of Transformation of Axes and its uses for the reduction of General Equation of Second Degree to Canonical form CO2: Understanding geometry of two-dimensional plane figures CO3: Familiarize with Polar Co-ordinate system and polar equation of line, circle, conics & tangent and normal to conics
<b>SEM II</b>			
BMTMCCRT-201	<b>ORDINARY DIFFERENTIAL EQUATIONS &amp; LINEAR ALGEBRA-I</b>	Unit 1: ODE	CO1: Familiarize with First order linear Ordinary Differential Equations and their solution techniques CO2: Identification and solution techniques of First order non-linear Ordinary Differential Equations CO3: Understanding of applications of First order Ordinary Differential Equations, Orthogonal

			<p>Trajectories</p> <p>CO4: Familiarize with different solution techniques of Higher order linear Ordinary Differential Equations with constant co-efficients and variable co-efficients</p> <p>CO5: Understanding simultaneous linear Ordinary Differential Equations and Total Differential equations</p>
		<b>Unit 2: Linear Algebra</b>	<p>CO1: Concept of vector space, Basis and Dimension of a finite dimensional vector space</p> <p>CO7: Acquainted with the Existence of solutions of system of Linear Equations and their solution techniques</p>
<b>SEM III</b>			
<b>BMTMCCRT-301</b>	<b>ANALYTICAL GEOMETRY (3D) &amp; VECTOR ANALYSIS</b>	<b>Unit 1: 3D Geometry</b>	<p>CO1: Understanding the concept of Three-dimensional space and it's geometry</p> <p>CO2: Understanding the geometrical characteristics of Sphere, Cone, Cylinder and the Generators of the Quadrics</p> <p>CO3: Concept of Central Conicoids like Ellipsoid, Hyperboloids of One or Two Sheets</p> <p>CO4: Familiarize with Generating lines with Ruled and Skew Surfaces</p> <p>CO5: Understanding the concepts of Transformation of co-ordinate axes in three dimensions and reduction of Second degree equations to its canonical form</p>
		<b>Unit 2: Vector Analysis</b>	<p>CO1: Understanding the Product of three or more vectors</p> <p>CO2: Concept of Vector Calculus, Differentiation and Integration of vector-valued functions</p> <p>CO3: Idea of Gradient, Divergence &amp; Curl of Vectors and their properties</p> <p>CO4: Understanding of Line integral. Surface integral and Volume integral of vector functions; applications of Green's theorem</p>

			and Stokes' theorem
<b>BMTMSERT-304 (SEC-I)</b>	<b>LOGIC &amp; SETS</b>	<b>Unit 1: Logic &amp; Sets</b>	CO1: Concept of propositions and truth table CO2: Precedence of logical operators and propositional equivalency CO3: Concept of predicates and quantifiers CO4: Elementary idea of sets and Relations with their applications
<b>SEM IV</b>			
<b>BMTMCCRT-401</b>	<b>PARTIAL DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORM &amp; TENSOR ANALYSIS</b>	<b>Unit 1: PDE</b>	CO1 : Understanding the basic concepts of Partial Differential Equations CO2: Familiarize with Formation and Solution techniques of linear and non-linear Partial Differential Equations
		<b>Unit2: Laplace Transform</b>	CO1: Understanding the basic concepts of Laplace Transform and the idea Laplace Transform of Some Elementary Functions & Derivatives CO2: Understanding the Convolution Theorem & Inverse of Laplace Transform and application of Laplace Transform in Ordinary Differential Equations
		<b>Unit 3: Tensor Analysis</b>	CO1: Understanding the Tensor as generalized concept of Vector in $E_3$ and $E_n$ CO2: Understanding Covariant, Contravariant and Mixed Tensors, Algebra of tensors, Contraction, Outer and Inner product, Quotient law in Tensors CO3: Familiarize with Metric tensor of Riemannian Space, Christoffel Symbols and covariant differentiation of tensors

<b>BMTMSERT-404 (SEC-II)</b>	<b>GRAPH THEORY</b>	<b>Unit 1: Graph Theory</b>	<p>CO1: Concept and basic properties of Graphs</p> <p>CO2: Understanding of Eulerian and Hamiltonian Graphs</p> <p>CO3: Representation of Graph by matrix (Adjacency and incidence matrix)</p> <p>CO4: Understanding of Travelling Salesman Problem using Graphs</p>
<b>SEM V</b>			
<b>BMTMDSRT-1 (DSE-I)</b>	<b>LINEAR PROGRAMMING</b>	<b>Unit 1: Linear Programming</b>	<p>CO1: Introduction of the Optimization Problems and Formation of Linear Programming Problem</p> <p>CO2: Familiarize with the basic theorems of LPP and concepts of Convex Sets, Convex Functions, Feasible and Basic Feasible Solutions of LPP</p> <p>CO3: Understanding the idea of Simplex Algorithm as a Solution technique of LPP and Duality Theory</p> <p>CO4: Understanding of Transportation and Assignment Problems with their solution techniques</p> <p>CO5: Introduction of the concept of Game Theory, Two-Person-Zero-Sum Game</p> <p>CO6: Familiarize with different solution techniques of Game Problems</p>
<b>BMTMDSRT-504 (SEC-III)</b>	<b>NUMERICAL METHODS</b>	<b>Unit 1: Numerical Methods</b>	<p>CO1: Understanding the concept of Convergence, Errors, Rounding-off, Truncation in Numerical methods</p> <p>CO2: Familiarize with Interpolation for equispaced and un-equispaced arguments</p> <p>CO3: Understanding different solution methods for finding root of algebraic and transcendental equations with their geometrical interpretations and convergence conditions</p> <p>CO4: Understanding the solution technique of system of equations</p>
<b>SEM VI</b>			
<b>BMTMDSRT-3 (DSE-III)</b>	<b>PROBABILITY AND STATISTICS</b>	<b>Unit-1: Probability</b>	<p>CO1: Acquire in depth knowledge of Probability, probability density function, probability distribution function, moment generating functions for discrete and continuous variables</p>

			CO2: Understanding the joint cumulative distribution function, probability density function and expectations
		<b>Unit-2: Statistics</b>	CO1: To develop the concept of statistical population and random sample, sampling distribution sample mean with $\chi^2$ and $t$ distribution CO2: Familiarize with the concept of Testing of hypothesis based on $z$ , $\chi^2$ and $t$ distributions
<b>BMTMDSRT-604 (SEC-IV)</b>	<b>BASIC C-PROGRAMMING</b>	<b>Basic C Programming</b>	CO1: Introduction C programming language; its structure, operators, keywords CO2: Familiarize with some simple programs using C language to solve numerical problems

## MATHEMATICS(GE)

<b>Course code</b>	<b>Course title</b>	<b>Unit/ Topic</b>	<b>Course outcomes</b>
<b>BMTMGERT10</b>	<b>Basics of Higher Mathematics-I</b>	<b>Unit-I: Classical Algebra</b>	CO1: Understanding of De-Moivre's theorem and its application CO2: knowledge of Descartes' rule of sign CO3: Solution of cubic equation by Cardan's method
		<b>Unit-II: Linear Algebra</b>	CO1: Knowing the concepts of rank of a matrix, inverse of matrix, solution of a system of linear equations CO2: Understanding Cayley Hamilton theorem
		<b>Unit-III: Differential Calculus</b>	CO1: Familiarize with Higher Order Derivatives & Leibnitz Rule for Successive Differentiation with its applications CO2: Understanding the basic ideas Partial Derivatives and applications of Euler's Theorem

			CO3: Knowing Taylor's and Maclaurin's Theorem
		<b>Unit-IV: Vector Calculus</b>	CO1: understanding differentiability of vector valued function of one variable CO2: Concepts of Gradient, Divergence, Curl of vector valued functions
<b>BMTMGERT10A</b>	<b>Basics of Higher Mathematics-II</b>	<b>Unit-I: Abstract Algebra</b>	CO1: Preliminary knowledge of Group, ring, field
		<b>Unit-II: Analytical Geometry (2D)</b>	CO1: Understanding of Transformation of Axes and its uses for the reduction of General Equation of Second Degree to Canonical form CO2: Concepts of pair of straight lines & geometry of 2D dimensional plane Familiarize with Polar Co- ordinate system and polar equation of line, circle, conics & tangent and normal to conics
		<b>Unit-III: Analytical Geometry (3D)</b>	CO1: Concepts of plane, straight line, sphere in three dimension
		<b>Unit-IV: Integral Calculus &amp; Differential Equation</b>	CO1: Derivation of simple reduction formulae CO2: Solution of 1 <sup>st</sup> order and 1 <sup>st</sup> degree equation, exact equation etc.

## **PROGRAM OUTCOMES (PO)**

### **PO1: Analytical Reasoning**

After completing the course in mathematics, the student will be able to apply the ideas of limit, continuity, and differentiability to solve issues in the social and physical sciences and grasp their basic importance in them.

### **PO2: Efficient Communication**

Mathematical reasoning is the universal language used to construct, evaluate, and draw conclusions from issues that can be solved using both conventional and computational approaches.

### **PO3: Social Interaction**

The learner will be able to name and explain the fundamental ideas that underlie mathematical methods used in government, business, and academia.

### **PO4: Sustainability and the Environment**

In order to develop long-term answers to complex problems in fields like space research, earth sciences, healthcare, and environmental protection, mathematics is essential.

### **PO5: Autonomy and Lifelong Learning**

The development of our contemporary society is greatly aided by mathematics. This field enables B.Sc. math graduates to effectively communicate orally and in writing while expressing theoretical and applied concepts.

### **PO6: Ethics**

Pupils will recognize the fundamental role that mathematics plays in society and use this to guide their ethical behavior when it comes to issues that mathematicians face, such as understanding how to rationally handle contemporary computational and numerical methods, environmental concerns, and important social issues pertaining to energy and biomathematical modeling.