# Department of Mathematics
# NISTARINI COLLEGE, PURULIA

**NAAC Accredited with 'A' Grade (CGPA 3.30) in 2015**
**(Affiliated to Sidho-Kanho-Birsha University, Purulia, W.B.)**



# Programme Outcomes,
# Programme Specific Outcomes
# & Course Outcomes

**DESHBANDU ROAD PURULIA-723101**

**www.nistarinicollege.ac.in,**

**e-mail: collegenistarini@gmail.com,**

Phone: 03252-222064; Mob: +91943400955

# Programme Outcomes: B.Sc.

PO-1  Students pass out this programme become adept in hands-on activities

PO-2  Students get conversant with different recent trends of scientific works happening in and around

PO-3  Students become workable and thus if they want they can opt for job and/or such training courses

PO-4  Students become highly cognizant of the expansion of the learning in their respective field which enables them to get admitted to the premier institutes of the country

PO-5  An aptitude to research is also stimulated in the minds of this budding generation which prompts them to take up some projects in good laboratories of the country after completing the programme

PO-6  One most significant outcome of the programme is the inculcation of higher values of life among the learners that enable them to face any hazard of the future life.

# Programme Specific Outcomes: B.Sc. in Mathematics

**PSO-1** Development of logical and analytical skills for abstract thinking which Is required for higher studies

**PSO-2** Learn advanced topics in Mathematics that will pave their way for further studies in Mathematics

**PSO-3** Formulate and develop mathematical arguments in a logical manner

**PSO-4** Acquire good knowledge and understanding in advanced areas of Mathematics and Statistics from the given courses

**PSO-5** Formulation of mathematical problems from real life situations their analysis and possible solutions

**PSO-6** Learn mathematical techniques required for jobs in educational, banking, corporate, IT sectors, etc

# COURSE OUTCOMES:
## Mathematics (Hons.)

### SEMESTER 1

| Course Code | Course Title | | Course Outcomes |
|---|---|---|---|
| BMTMCCHT-101 | DIFFERENTIAL & INTEGRAL CALCULUS | CO-1 | Familiarize with Higher Order Derivatives & Leibnitz Rule for Successive Differentiation with its applications |
| | | CO-2 | Understanding of Intermediate Forms & L'Hospital's Rule |
| | | CO-3 | Understanding the basic ideas Partial Derivatives and applications of Euler's Theorem |
| | | CO-4 | Familiarize with applications of Differential Calculus |
| | | CO-5 | Familiarize with Reduction Formulae in Integration and applications of Integral Calculus |
| | ANALYTICAL GEOMETRY (2D) | CO-6 | Understanding of Transformation of Axes and its uses for the reduction of General Equation of Second Degree to Canonical form |
| | | CO-7 | Understanding geometry of two-dimensional plane figures |
| | | CO-8 | Familiarize with Polar Co-ordinate system and polar equation of line, circle, conics & tangent and normal to conics |
| BMTMCCHT-102 | CLASSICAL ALGEBRA | CO-1 | Understanding of De-Moivre's theorem and its application |
| | | CO-2 | Understanding of Rolle's theorem and its application |
| | | CO-3 | Learn methods to solve equations, transformed equations, cubic, bi-quadratic and reciprocal equations |
| | | CO-4 | Familiarize with A.M, G.M, & H.M and useful inequalities |
| | | CO-5 | Familiarize with Simple Continued Fractions and its convergent |
| | ABSTRACT ALGEBRA-I | CO-6 | Concept of Mappings, Equivalence Relation and Lattice |
| | NUMBER THEORY | CO-7 | Concept of Mathematical Induction & Fundamental Theorem of Arithmetic |
| | | CO-8 | Understanding of Euclid's Algorithm, GCD, LCM |
| | | CO-9 | Understand the definitions of congruence, power of congruence and related theorems |
| | | CO-10 | Familiarize with Euler's $\varphi$-function , Mobius $\mu$-function and Solution of Diophantine Equation |

| | | SEMESTER II | | |
|---|---|---|---|---|
| **Course Code** | **Course Title** | **Course Outcomes** | | |
| **BMTMCCHT-201** | **REAL ANALYSIS-I** | CO-1 | Understand algebraic & order properties of Real numbers and completeness of Real numbers | |
| | | CO-2 | Idea of countable and uncountable sets | |
| | | CO-3 | Concept of limit points, open sets and closed sets | |
| | | CO-4 | Concept of Sequence and Series of Real numbers and their convergences | |
| **BMTMCCHT-202** | **ORDINARY DIFFERENTIAL EQUATIONS** | CO-1 | Familiarize with First order linear Ordinary Differential Equations and their solution techniques | |
| | | CO-2 | Identification and solution techniques of First order non-linear Ordinary Differential Equations | |
| | | CO-3 | Understanding of applications of First order Ordinary Differential Equations, Orthogonal Trajectories | |
| | | CO-4 | Familiarize with different solution techniques of Higher order linear Ordinary Differential Equations with constant co-efficients and variable co-efficients | |
| | | CO-5 | Understanding simultaneous linear Ordinary Differential Equations and Total Differential equations | |
| | **LINEAR ALGEBRA-I** | CO-6 | Concept of vector space, Basis and Dimension of a finite dimensional vector space | |
| | | CO-7 | Acquainted with the Existence of solutions of system of Linear Equations and their solution techniques | |

| SEMESTER III | | |
|---|---|---|
| **Course Code** | **Course Title** | **Course Outcomes** |
| BMTMCCHT-301 | **REAL ANALYSIS-II** | CO-1 Concept of limit, continuity and differentiability of functions of one and several variables |
| | | CO-2 Mean value theorems and their applications |
| | | CO-3 Finding series expansion of various functions |
| | | CO-4 Finding extremum of functions including the method of Lagrange's multipliers |
| | | CO-5 Idea of double and triple integration to find area and volume |
| BMTMCCHT-302 | **ABSTRACT ALGEBRA-II** | CO-1 Concept of Groups, Subgroups, Cyclic groups, Permutations groups, Centralizer, Normalizer |
| | | CO-2 Learn Lagrange's theorem and it's consequences including Fermat's little theorem |
| | | CO-3 Understand the concept of Rings and Fields |
| BMTMCCHT-303 | **ANALYTICAL GEOMETRY (3D)** | CO-1 Understanding the concept of Three-dimensional space and it's geometry |
| | | CO-2 Understanding the geometrical characteristics of Sphere, Cone, Cylinder and the Generators of the Quadrics |
| | | CO-3 Concept of Central Conicoids like Ellipsoid, Hyperboloids of One or Two Sheets |
| | | CO-4 Familiarize with Generating lines with Ruled and Skew Surfaces |
| | | CO-5 Understanding the concepts of Transformation of co-ordinate axes in three dimensions and reduction of Second degree equations to its canonical form |
| | **VECTOR ANALYSIS** | CO-6 Understanding the Product of three or more vectors |
| | | CO-7 Concept of Vector Calculus, Differentiation and Integration of vector-valued functions |
| | | CO-8 Idea of Gradient, Divergence & Curl of Vectors and their properties |
| | | CO-9 Understanding of Line integral. Surface integral and Volume integral of vector functions; applications of Green's theorem and Stokes' theorem |
| BMTMSEHT-305 (SEC-1) | **LOGIC & SETS** | CO-1 Concept of propositions and truth table |
| | | CO-2 Precedence of logical operators and propositional equivalency |
| | | CO-3 Concept of predicates and quantifiers |
| | | CO-4 Elementary idea of sets and Relations with their applications |

| SEMESTER IV | | | | |
|---|---|---|---|---|
| **Course Code** | **Course Title** | | **Course Outcomes** | |
| BMTMCCHT-401 | DYNAMICS OF PARTICLES | CO-1 | Understanding the concept of motion of a particle in a straight line in resisting and non-resisting medium | |
| | | CO-2 | Familiarize with Simple Harmonic Motion and its applications | |
| | | CO-3 | Understanding the concept of Impulsive Forces and its application in collision of elastic bodies | |
| | | CO-4 | Understanding the concept of motion of a particle in two dimensional Cartesian plane | |
| | | CO-5 | 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 | |
| | | CO-6 | Conceptualize the idea of Constrained Motion | |
| BMTMCCHT-402 | PARTIAL DIFFERENTIAL EQUATIONS | CO-1 | Understanding the basic concepts of Partial Differential Equations | |
| | | CO-2 | Familiarize with Formation and Solution techniques of linear and non-linear Partial Differential Equations | |
| | LAPLACE TRANSFORM | CO-3 | Understanding the basic concepts of Laplace Transform and the idea Laplace Transform of Some Elementary Functions & Derivatives | |
| | | CO-4 | Understanding the Convolution Theorem & Inverse of Laplace Transform and application of Laplace Transform in Ordinary Differential Equations | |
| | TENSOR ANALYSIS | CO-5 | Understanding the Tensor as generalized concept of Vector in $E_3$ and $E_n$ | |
| | | CO-6 | Understanding Covariant, Contravariant and Mixed Tensors, Algebra of tensors, Contraction, Outer and Inner product, Quotient law in Tensors | |
| | | CO-7 | Familiarize with Metric tensor of Riemannian Space, Christoffel Symbols and covariant differentiation of tensors | |
| BMTMCCHT-403 | REAL ANALYSIS-III | CO-1 | Acquire in-depth knowledge of Riemann and Improper Integration | |
| | | CO-2 | Understanding of the Convergence of Beta and Gamma functions | |
| | | CO-3 | Concept of sequence and series of functions and their convergences | |
| | | CO-4 | Learn Fourier series and Fourier expansion of functions | |
| | | CO-5 | Understand the Power series & finding radius and interval of convergence of power series | |
| BMTMSEHT-405 (SEC-2) | GRAPH THEORY | CO-1 | Concept and basic properties of Graphs | |
| | | CO-2 | Understanding of Eulerian and Hamiltonian Graphs | |
| | | CO-3 | Representation of Graph by matrix (Adjacency and incidence matrix) | |
| | | CO-4 | Understanding of Travelling Salesman Problem using Graphs | |

| SEMESTER V | | |
|---|---|---|
| **Course Code** | **Course Title** | **Course Outcomes** |
| BMTMCCHT-501 | **ABSTRACT ALGEBRA-III** | CO-1 Understanding the concept of Quotient groups and Quotient Rings |
| | | CO-2 Familiarize with Isomorphism Theorems of Groups and Rings |
| | **LINEAR ALGEBRA-II** | CO-3 Understanding the Linear Transformation and Matrix representation of a Linear Transformation |
| | | CO-4 Concept of Eigen values and Eigen vectors of a matrix and Diagonalization of Matrices of order 2 and 3 |
| | | CO-5 Understanding the concept of Elementary of Inner Product Spaces and Norms |
| BMTMCCHT-502 | **METRIC SPACES** | CO-1 Idea of Metric Spaces with some standard examples |
| | | CO-2 Familiarize with Continuity and Homeomorphisms in Metric Spaces |
| | | CO-3 Detailed study of Compactness, Connectedness and Completeness of Metric Spaces |
| | **COMPLEX ANALYSIS** | CO-4 Understanding the Stereographic projection of complex number and extended complex plane |
| | | CO-3 Understanding the Concept of Limit, Continuity and Differentiability of a complex function and Cauchy-Riemann equation |
| | | CO-4 Understanding the Concept of Conformal mappings and Bilinear transformations |
| BMTMDSHT-1 (DSE-1) | **LINEAR PROGRAMMING** | CO-1 Introduction of the Optimization Problems and Formation of Linear Programming Problem |
| | | CO-2 Familiarize with the basic theorems of LPP and concepts of Convex Sets, Convex Functions, Feasible and Basic Feasible Solutions of LPP |
| | | CO-3 Understanding the idea of Simplex Algorithm as a Solution technique of LPP and Duality Theory |
| | | CO-4 Understanding of Transportation and Assignment Problems with their solution techniques |
| | | CO-5 Introduction of the concept of Game Theory, Two-Person-Zero-Sum Game |
| | | CO-6 Familiarize with different solution techniques of Game Problems and also solving Game Problems using LPP |
| BMTMDSHT-2 (DSE-2) | **MECHANICS-I** | CO-1 Concept and basics of Classical Dynamics, Inertial Frames, Galilean Transformation and its applications |
| | | CO-2 Understanding of the motion of System of Particles |
| | | CO-3 Understanding the Moments and Product of Inertia and M.I. and P.I. of some Plane Laminas and Rigid Bodies |
| | | CO-4 Understanding of Projection Dynamics, the Two-dimensional motion of Rigid Bodies |

| Course Code | Course Title | | Course Outcomes | |
|---|---|---|---|---|
| **SEMESTER VI** | | | | |
| BMTMCCHT-601 | **NUMERICAL METHODS** | CO-1 | Understanding the concept of Convergence, Errors, Rounding-off, Truncation in Numerical methods | |
| | | CO-2 | Familiarize with Interpolation for equispaced and un-equispaced arguments | |
| | | CO-3 | Understanding different solution methods for finding root of algebraic and transcendental equations with their geometrical interpretations and convergence conditions | |
| | | CO-4 | Familiarize with solution methods of system of linear equations | |
| | | CO-5 | Concept of Numerical Integration, idea of Newton-Cotes' quadrature formula, Trapezoidal and Simpson's formula | |
| | | CO-6 | 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 | |
| | **COMPUTER PROGRAMMING** | CO-7 | Familiarize with computer system, Hardware and Software of Computers | |
| | | CO-8 | To develop the idea of Binary number system and computer languages, ML, AL & HLL | |
| | | CO-9 | Introduction C programming language; its structure, operators, keywords and some simple programs using C language to solve numerical problems | |
| BMTMCCHS-602 | **COMPUTER AIDED NUMERICAL PRACTICAL** | CO-1 | Familiarize with hand-on experience of using computers for solving numerical problems | |
| | | CO-2 | Understand to write the programs using C language for solving interpolation problem, finding root of an equation, solving numerical integration and differential equations | |
| BMTMDSHT-4 (DSE-3) | **PROBABILITY** | CO-1 | Acquire in depth knowledge of Probability, probability density function, probability distribution function, moment generating functions for discrete and continuous variables | |
| | | CO-2 | Understanding the joint cumulative distribution function, probability density function and expectations | |
| | **STATISTICS** | CO-3 | To develop the concept of statistical population and random sample, sampling distribution sample mean with $\chi^2$ and $t$ distribution | |
| | | CO-4 | Familiarize with the concept of Testing of hypothesis based on $z$, $\chi^2$ and $t$ distributions | |
| BMTMDSHT-5 (DSE-4) | **MECHANICS-II** | CO-1 | Familiarize with Statics, Reduction of forces in three dimensions and its resultant, concept of couple and Poinsot's central axis | |
| | | CO-2 | Understanding the concept of virtual work and its applications, Stable and unstable equilibrium and idea of equilibrium of heavy inextensible string | |
| | | CO-3 | To develop the concept of continuum mechanics | |
| | | CO-4 | To develop the concept of equilibrium of fluids in a field of force, pressure and thrust on heavy fluids | |
| | | CO-5 | Familiarize with equation of state of perfect gas, isothermal and adiabatic process in an isothermal atmosphere. | |

| COURSE OUTCOMES: |||
|---|---|---|
| **Mathematics (Regular Program)** |||
| **SEMESTER 1** |||
| **Course Code** | **Course Title** | **Course Outcomes** |
| **BMTMCCRT-101** | **DIFFERENTIAL & INTEGRAL CALCULUS** | CO-1 Familiarize with Higher Order Derivatives & Leibnitz Rule for Successive Differentiation with its applications |
| | | CO-2 Understanding of Intermediate Forms |
| | | CO-3 Understanding the basic ideas Partial Derivatives and applications of Euler's Theorem |
| | | CO-4 Familiarize with applications of Differential Calculus |
| | | CO-5 Familiarize with Reduction Formulae in Integration and applications of Integral Calculus |
| | **ANALYTICAL GEOMETRY (2D)** | CO-6 Understanding of Transformation of Axes and its uses for the reduction of General Equation of Second Degree to Canonical form |
| | | CO-7 Understanding geometry of two-dimensional plane figures |
| | | CO-8 Familiarize with Polar Co-ordinate system and polar equation of line, circle, conics & tangent and normal to conics |
| **SEMESTER II** |||
| **Course Code** | **Course Title** | **Course Outcomes** |
| **BMTMCCRT-201** | **ORDINARY DIFFERENTIAL EQUATIONS** | CO-1 Familiarize with First order linear Ordinary Differential Equations and their solution techniques |
| | | CO-2 Identification and solution techniques of First order non-linear Ordinary Differential Equations |
| | | CO-3 Understanding of applications of First order Ordinary Differential Equations, Orthogonal Trajectories |
| | | CO-4 Familiarize with different solution techniques of Higher order linear Ordinary Differential Equations with constant co-efficients and variable co-efficients |
| | | CO-5 Understanding simultaneous linear Ordinary Differential Equations and Total Differential equations |
| | **LINEAR ALGEBRA-I** | CO-6 Concept of vector space, Basis and Dimension of a finite dimensional vector space |
| | | CO-7 Acquainted with the Existence of solutions of system of Linear Equations and their solution techniques |

| SEMESTER III | | |
|---|---|---|
| **Course Code** | **Course Title** | **Course Outcomes** |
| BMTMCCRT-301 | ANALYTICAL GEOMETRY (3D) | CO-1 Understanding the concept of Three-dimensional space and it's geometry |
| | | CO-2 Understanding the geometrical characteristics of Sphere, Cone, Cylinder and the Generators of the Quadrics |
| | | CO-3 Concept of Central Conicoids like Ellipsoid, Hyperboloids of One or Two Sheets |
| | | CO-4 Familiarize with Generating lines with Ruled and Skew Surfaces |
| | | CO-5 Understanding the concepts of Transformation of co-ordinate axes in three dimensions and reduction of Second degree equations to its canonical form |
| | VECTOR ANALYSIS | CO-6 Understanding the Product of three or more vectors |
| | | CO-7 Concept of Vector Calculus, Differentiation and Integration of vector-valued functions |
| | | CO-8 Idea of Gradient, Divergence & Curl of Vectors and their properties |
| | | CO-9 Understanding of Line integral. Surface integral and Volume integral of vector functions; applications of Green's theorem and Stokes' theorem |
| BMTMSERT-304 (SEC-1) | LOGIC & SETS | CO-1 Concept of propositions and truth table |
| | | CO-2 Precedence of logical operators and propositional equivalency |
| | | CO-3 Concept of predicates and quantifiers |
| | | CO-4 Elementary idea of sets and Relations with their applications |
| SEMESTER IV | | |
| **Course Code** | **Course Title** | **Course Outcomes** |
| BMTMCCRT-401 | PARTIAL DIFFERENTIAL EQUATIONS | CO-1 Understanding the basic concepts of Partial Differential Equations |
| | | CO-2 Familiarize with Formation and Solution techniques of linear and non-linear Partial Differential Equations |
| | LAPLACE TRANSFORM | CO-3 Understanding the basic concepts of Laplace Transform and the idea Laplace Transform of Some Elementary Functions & Derivatives |
| | | CO-4 Understanding the Convolution Theorem & Inverse of Laplace Transform |
| | TENSOR ANALYSIS | CO-5 Understanding the Tensor as generalized concept of Vector in $E_3$ and $E_n$ |
| | | CO-6 Understanding Covariant, Contravariant and Mixed Tensors, Algebra of tensors, Contraction, Outer and Inner product, Quotient law in Tensors |
| | | CO-7 Familiarize with Metric tensor of Riemannian Space, Christoffel Symbols and covariant differentiation of tensors |
| BMTMSERT-404 (SEC-2) | GRAPH THEORY | CO-1 Concept and basic properties of Graphs |
| | | CO-2 Understanding of Eulerian and Hamiltonian Graphs |
| | | CO-3 Representation of Graph by matrix (Adjacency and incidence matrix) |
| | | CO-4 Understanding of Travelling Salesman Problem using Graphs |

| SEMESTER V | | |
|---|---|---|
| **Course Code** | **Course Title** | **Course Outcomes** |
| **BMTMDSRT-1 (DSE-1)** | **LINEAR PROGRAMMING** | CO-1 Introduction of the Optimization Problems and Formation of Linear Programming Problem |
| | | CO-2 Familiarize with the basic theorems of LPP and concepts of Convex Sets, Convex Functions, Feasible and Basic Feasible Solutions of LPP |
| | | CO-3 Understanding the idea of Simplex Algorithm as a Solution technique of LPP and Duality Theory |
| | | CO-4 Understanding of Transportation and Assignment Problems with their solution techniques |
| | | CO-5 Introduction of the concept of Game Theory, Two-Person-Zero-Sum Game |
| | | CO-6 Familiarize with different solution techniques of Game Problems and also solving Game Problems using LPP |
| **BMTMDSRT-504 (SEC-3)** | **NUMERICAL METHODS** | CO-1 Understanding the concept of Convergence, Errors, Rounding-off, Truncation in Numerical methods |
| | | CO-2 Familiarize with Interpolation for equispaced and un-equispaced arguments |
| | | CO-3 Understanding different solution methods for finding root of algebraic and transcendental equations with their geometrical interpretations and convergence conditions |
| | | CO-4 Understanding the solution technique of system of equations |
| SEMESTER VI | | |
| **Course Code** | **Course Title** | **Course Outcomes** |
| **BMTMDSRT-3 (DSE-3)** | **PROBABILITY** | CO-1 Acquire in depth knowledge of Probability, probability density function, probability distribution function, moment generating functions for discrete and continuous variables |
| | | CO-2 Understanding the joint cumulative distribution function, probability density function and expectations |
| | **STATISTICS** | CO-3 To develop the concept of statistical population and random sample, sampling distribution sample mean with $\chi^2$ and $t$ distribution |
| | | CO-4 Familiarize with the concept of Testing of hypothesis based on $z$, $\chi^2$ and $t$ distributions |
| **BMTMDSRT-604 (SEC-4)** | **BASIC C-PROGRAMMING** | CO-1 Introduction C programming language; its structure, operators, keywords |
| | | CO-2 Familiarize with some simple programs using C language to solve numerical problems |