SIDDHINATH MAHAVIDYALAYA
(Govt. Aided)
Estd.- 2013
SHYAMSUNDARPUR PATNA • PANSKURA • PURBA MEDINIPUR • PIN - 721139 • Phone - 03228-255030
email - siddhinathmahavidyalaya@gmail.com

B.S.C HONOURS

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MATHEMATICS

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B. SC. HONOURS IN MATHEMATICS

CBCS

PROGRAMME SPECIFIC OUTCOME (PSO)

By the end of the program UG in Mathematics, the student will be able to:

- Demonstrate in-depth knowledge in one of the foundational areas of the mathematical sciences.
- Communicate mathematical ideas using numerical, graphical, and symbolic representations.
- Construct abstract models using appropriate mathematical and statistical tools.
- Analyze, test, and interpret technical arguments, and form independent judgments.
- Solve complex problems by identifying feasible divisions into simpler subproblems.
- Gather and organize relevant qualitative and quantitative information such as related problems, examples, and counterexamples.
- To improve their performance in math competitions (like IIT-JAM, TIFR, NBHM, CSIR- NET), as well as their general mathematical skills if math competitions are not their main goal their higher studies

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Course Outcome (CO)

MTMHCC01: Calculus, Geometry & Differential Equation Outcomes:

Calculus:

• Students will be able to differentiate a function successively.

• Students will be able to integrate functions like sin$n$ x, cos$n$ x,… by applying the reduction formula. • Students will learn about the hyperbolic function, concavity, and inflection points.

• Students will be able to find envelopes and asymptotes of a curve.

• Students will know and indeterminate form and be able to solve this type of problem.

• Students will be able to sketch graphs of various curves.

• Students will be able to obtain the surface of the revolution of curves. Geometry

• Students will be able to classify the conics with the help of a determinant and find their canonical forms.

• Students will have clear concepts about the polar coordinate section.

• Students will know about conicoid in three dimensions and be able to solve various problems regarding conicoids.

Differential equation:

• Students will be able to formulate differential equations from various practical problems and solve them.

• Students will be able to solve various types of differential equations of 1st order.

•Students will be able to sketch ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using cartesian coordinates.

MTMHCC02: Algebra Outcomes:

• Students will be able to know about the polar form of a complex number and be experts in solving problems of complex numbers in polar form.

• Students will be experts in solving an algebraic equation up to degree 4 and able to solve various inequality problems

• Students will know about equivalence relations and their properties.

• Students will know about functions, the composition of functions, Invertible functions, one-to-one correspondence, and the cardinality of a set.

• Student will know about the fundamental theorem of arithmetic.

• Students will be able to solve a system of linear equations.

• Students will know the fundament definition and ideas of linear transformations.

MTMHCC03: Real Analysis Outcomes:

• Students will know the fundament topological concepts and many properties of real number systems.

• Students will know about sequence and infinite series of real numbers and be able to solve problems regarding sequence and series.

MTMHCC04: Differential Equations & Vector Calculus Outcomes:

• Students will able to solve differential equations 2nd order and know about the power series solution of a differential equation.

• Students will obtain the basic concepts of vector differentiation and integration.

MTMHCC05: Theory of Real Functions & Introduction to Metric Space Outcomes:

• Students will know the concept and various theorems on limit, continuity, and differentiation of a real function and can solve various problems regarding this.

• Students will obtain the basic concepts of metric space and its properties.

MTMHCC06: Group Theory 1 Outcomes:

• Students will know the concept, definitions, and various theorems on Group, subgroup, centralizer, normalizer, center of the group, cyclic group, permutations, normal subgroups, factor group, and external and internal direct product of groups.

• Students will also be able to solve various problems on the aforesaid topics.

• Students will know the definitions, properties, and various problems on homomorphism, isomorphism, and automorphism.

• Students will learn First, Second, and Third isomorphism theorems with their proof.

MTMHCC07: Numerical Methods Outcomes:

• Students will know about rounding off a number and possible errors regarding roundoff

. • Students will be able to solve various types of equations, differentiate and integrate various functions and solve various differential equations by numerical methods.

• Students will be able to solve the above problems by C++ programming in the departmental lab.

MTMHCC08: Riemann Integration and Series of Functions Outcomes:

• Students will know the concept, definitions, and various theorems on Riemann and Improper integral and can integrate various functions by those methods.

• Students will know about the sequence of functions, series of functions, power series, and Fourier series and can solve various problems.

MTMHCC09: Multivariate Calculus Outcomes:

• Students will know about the difference between derivation and differentiation.

• Students will be experts in calculating double and triple integrals by the calculus method and vector method.

• Students will be experts in calculating area, surface, and volume by integration method.

• Students will know the relation between single, double, and triple integral.

MTMHCC10: Ring Theory and Linear Algebra I Outcomes:

• Students will know definitions, examples, and properties of the ring, integral domain, field, subring, ideals, and factor ring.

• Students will know the basic concept of vector space.

• Students will be able to know the isomorphism in linear transformation.

MTMHCC11: Partial Differential Equations &Applications Outcomes:

• Students will know the basic concept of vector space.

• Students will know the basic concept of the partial differential equation.

• Students will be able to solve various types of 1st order partial differential equations and some special types of 2nd order partial differential equations like Wave equation, Heat equation, Cauchy problem, Semi-infinite string problem, etc.

• Students will know the basic concept of a central force, constrained motion, tangential and normal components of accelerations and velocity, planetary motion, and Keplar's law.

MTMHCC12: Group Theory II Outcomes:

• Students will know details about the automorphism group and properties of external and internal direct products.

• Students will learn about group action, p-group, Sylow theorem, and Cauchy theorem.

MTMHCC13: Metric Spaces and Complex Analysis Outcomes:

• Students will know details about convergence in metric space, limit, and continuity in metric space.

• Students will learn about the analytic function and its properties.

• Students will learn about various types of infinite series of a complex number and can solve problems from these chapters.

MTMHCC14: Ring Theory and Linear Algebra II Outcomes:

• Students will know about polynomial rings and their properties.

• Students will know about dual space and inner product space in vector space.

MTMHSE01: Logic & Sets Outcomes:

• Students will know about truth table, negation, conjunction, disjunction,implications, biconditional propositions, converse, contrapositive, and inverse propositions, and precedence of logical operators.

• Student will learn about Propositional equivalence and Predicates and quantifiers.

• Students will be able to know the definitions and properties of sets, subsets, finite sets,emptysets, classes of sets, andthe power set of a set.

• Students can solve various problems on difference and symmetric difference of two sets, union, and intersections of sets,and relations.

MTMHSE02: Graph Theory Outcomes:

• Students knows about definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bipartite graphs isomorphism of graphs.

• Student will learn about Eulerian circuits, Eulerian graph, semi-Eulerian graph, theorems, Hamiltonian cycles,the matrix representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph,

• Student will learn about Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.

MTMHDS01: Theory of Equations Outcomes:

• Student will learn about deneral properties of polynomials, Graphical representation of a polynomial, maximum and minimum values of a polynomials, General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations.

• Students can solve problems on Symmetric functions, Transformation of equations,Reciprocal and binomial equations, Cubic and biquadratic

• Student will learn about symmetric functions of the roots, Newton's theorem on the sums of powers of roots, homogeneous products, limits of the roots of equations.

• Student can separation of the rootsof equations by Strums theorem.

MTMHDS02: Probability & Statistics Outcomes:

• Student will learn about Sample space, Probability axioms, Real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.

• Students can solve problems on Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, the expectation of a function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function and calculation of covariance, linear regression for two variables.

• Students will learn about Chebyshev's inequality, (weak) law of large numbers and strong law of large numbers,the Central limit theorem for independent and identically distributed random variables with finite variance, Markov chains, ChapmanKolmogorov equations, and classification of states.

• Students can solve problems on Random Samples, Sampling Distributions, Estimation of parameters, and Testing of hypotheses.

MTMHDS03: Number Theory Outcomes:

• Student will know about Linear diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linearcongruences, complete set of residues. Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.

• Students will learn about Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

• Student will improve their concepts on order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the $x^2 + y^2 = z^2$, Fermat's Last theorem.

MTMHDS04: Mathematical Modelling Outcomes:

• Students will learn about the solution methodology of Bessel's equation and Legendre's equation by Power Series Method, Laplace transform and inverse transform, application to initial value problem up to second order.

• Student will briefly know about Monte Carlo simulation modelling, queuing models, Optimization model, Linear programming model.

MTMHGE01: Calculus, Geometry & Differential Equation Outcomes: Calculus:

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MTMHGE02: Algebra Outcomes:

• Students will be able to know about the polar form of a complex number and be experts in solving problems of complex numbers in polar form. • Students will be experts in solving an algebraic equation up to degree 4 and able to solve various inequality problems

• Students will know about equivalence relations and their properties. • Students will know about functions, the composition of functions, Invertible functions, one-to-one correspondence, and the cardinality of a set. • Students will know about the fundamental theorem of arithmetic.

• Students will be able to solve a system of linear equations.

• Students will know the fundament definition and ideas of linear transformations.

MTMHGE03: Differential Equations & Vector Calculus Outcomes:

• Students will able to solve differential equations 2nd order and know about the power series solution of a differential equation.

• Students will obtain the basic concepts of vector differentiation and integration.

MTMHGE04: Numerical Methods Outcomes:

• Students will know about rounding off a number and possible errors regarding roundoff.

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GEOGRAPHY

Programme-Specific Outcome or Course-Specific Outcome:

B.Sc. Honours in Geography CBCS

Programme Specific Outcome (PSO)

- **Developing a strong foundation of Geo-tectonics, Geomorphology, Bio-geography, Soil Geography, and instrumentation techniques and their applications to examine and appreciate the inherent complexity of landscape systems at the micro-level.**
- **Conceptualizing the basic atmospheric and climatic phenomena of the earth and their effect on man. Developing advanced level concepts of Remote Sensing and Geographical Information systems and their applications in present-day situations.**
- **Understanding the principles and applications of Hydrology and Oceanography to address water resource and environment-related problems. Conceptualizing the Social, Cultural, Political, and Settlement Geography and the ethical considerations associated with their environmental impact. Understanding the development of Geographical thought from the ancient period to recent times.**
- **Understanding and analysing the ground reality through field visits and field surveys of the selected area which may be either an urban or rural area. Field visits or survey was done for obtaining the primary data through Household survey, Road survey, Physical setup, etc. of the selected area. A field book was prepared after analysing data focusing on socio-economic conditions, land use & Land cover map of the surveyed area.**

Course Outcome (CO)

GEOHCC 01 Geo-Tectonics and Geomorphology

Outcomes:

It helps to understand the evolution of the earth along with the geological time scale, the arrangement, and structure of rock masses of the Earth's crust, about earth interior of earth, and the natural processes which act on the Earth's surfaces.

GEOHCC 02 Cartographic Techniques lab

Outcomes:

It helps us to visualize spatial distributions and relationships, the concept, types, components of map and scale, the various instruments can be recognised.

GEOHCC 03 Human Geography

Outcomes:

It examines human societies and how they develop, their culture, economy, and politics, all within the context of their environment. It focused on the recent trend of demographical and resource change and its effect on the socio-economic structure of the society.

GEOHCC 04 Cartograms and Thematic Mapping +lab

Outcomes:

It helps to understand the interpretation of map and to involve the superimposition of political, cultural, or other non-geographical divisions onto the representation of a geographical area. The map is produced in the lab.

GEOHCC 05 Climatology

Outcomes:

This content is very much useful to understand the atmospheric characteristics of all-weather elements. Various climatic classification can be understood. Global warming and other environmental issues are also focused by science.

GEOHCC 06 Statistical methods in Geography

Outcomes:

It is applied in all fields of academic research; wherever data are collected and summarized or wherever any numerical information is analysed. The calculation of numerous field data can be understood.

GEOHCC 07 Geography of India

Outcomes:

It helps to know the physical, cultural, and economic aspects of the country. It reflects the population policy and also the development of our nation. Regional problem can be delineated. Specific characteristics and classification of our country region. This is a very important subject to understand about our country.

GEOHCC 08 Regional planning and development

Outcomes:

It helps to know the specific unique characteristics of places related to their Culture, economy, topography, climate, politics, and environmental factors. It helps to understand the planning of a place in order to develop a region and also the changing concept.

GEOHCC 09 Economic Geography

Outcomes:

It helps to know the spatial aspects of wealth and poverty, innovation and Productivity, trade and exchange, and the world's non-random distribution of its Physical and human resources. It focused on the spatial distribution of Resources. Foreign relation can be made smooth with the exchange of product. Primary activities of our country can be recognised.

GEOHCC 10 Environmental Geography +lab

Outcomes:

It describes the spatial aspects of interactions between humans and the natural World. The changes of human civilization and ecosystem and pollution degradation of our nation with respect to environment can understood.

GEOHCC 11 Field work and Research Methodology +lab

Outcomes:

Fieldwork provides an opportunity for students to develop their sensitivity to appreciation of a wide range of different environments. Research methodology helps to identify, select, process, and analyse information about a topic. It can clear the concept of writing a project report.

GEOHCC 12 Remote sensing and GIS +lab

Outcomes:

It helps to acquire details about an object without physical on-site observation using satellite or aircraft. It also helps to detect anything's in the global navigation system.

GEOHCC 13 Evolution of Geographical thought

Outcomes:

It emphasizes the importance of geographic thought and its relevance to our understanding of what it is to be human, and to the people, places, and cultures of the world in which we live. The various contribution and trends and be known.

GEOHCC14 Disaster Management +Project work

Outcomes:

It helps to build an appreciation for the challenges and complexities involved in Disaster Management and should encourage students to reflect and spur creative

Ways for solving problems. The disaster case studies and management can be known and it can be shown through the mapping techniques.

GEOHGE01 Disaster Management

Outcomes:

It helps to build an appreciation for the challenges and complexities involved in Disaster Management.

GEOHGE02 Geospatial Technology

Outcomes:

Geospatial technology enables to acquisition of data that is referenced to the Earth and use it for analysis, modelling, simulations and visualization.

GEOHGE03 Geography of Tourism

Outcomes:

It helps to know about the spatial and temporal dynamics, as well as the Interactions between the tourism resources.