DESHABANDHU MAHAVIDYALAYA, CHITTARANJAN

3 YEARS DEGREE WITH MATHEMATICS/4 YEARS DEGREE WITH MATHEMATICS HONOURS/4 YEARS DEGREE WITH MATHEMATICS HONOURS WITH RESEARCH

w.e.f. Academic Session 2023-24

MATHEMATICS
Programme Specific Outcomes

PSO-1: It develops a greater global awareness of mathematics and mathematical sciences, and prepares to face the mathematical and/or scientific problems.

PSO-2: Understand the nature of mathematical proofs and be able to write proofs.

PSO-3: It develops or helps to develop to have analytical thinking procedures which generate the ability to investigate or unravelling the truth about the world around us

PSO-4: It can help the students to grow the ability of expertizing financial mathematics to create money in a legal way.

PSO-5: Develop the ability to read, understand and use basic definitions in linear and abstract algebra, real analysis, Geometry, and Calculus.

PSO-6: It helps to understand computer coding, artificial intelligence, machine learning and other computer technologies.

PSO-7: Mentally prepare the students to learn Mathematics leading to graduate degree with honours in Mathematics or with Mathematics as a subject.

Course Name		Course Content	Course Outcome (CO)
Semester I (NEP) M a j o r C o u r s e			
Classical Algebra, Calculus and Analytical Geometry	Classical Algebra	Unit-1	Students will learn about CO1: Employ De Moivre's theorem in a number of applications to solve numericalproblems.
		Unit-2	CO2: Understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots.
		Unit-3	CO3: Understand basic inequalities including Cauchy-Schwartz inequality, Weierstrass inequality and its application in obtaining maxima-minima
	Calculus	Unit-4	CO4: Understand higher order derivatives, Successive differentiation, Leibnitz rule and its applications, concavity and inflection points, envelopes,asymptotes, Maxima and Minima, Curvature
		Unit-5	CO5: Understand Reduction formulae, derivations and illustrations of reduction formulae for integration of various trigonometric functions. Evaluation of arc length, arc length of parametric curves, areas and volumes of surfaces of revolution.
	Analytical Geometry	Unit-6	CO6: Understand the concepts on two-dimensional geometry.
		Unit-7	CO7: Understand the concepts on three-dimensional geometry.
Graph Theory (SEC paper)	Graph Theory	Unit-1	CO8: Appreciate the definition and basics of graphs along with types and their examples.
		Unit- 2	CO9: Understand the Eulerian circuits, Eulerian graphs, Hamiltonian cycles, representationof a graph by matrix.
		Unit-3	CO10: Relate the graph theory to the real-world problems.

Course Name		Course Content	Course Outcome (CO)
Semester II (NEP) Major Course			
Linear Algebra I, Ordinary Differential Equations and Vector Calculus	Linear Algebra I	Unit-1	Students will learn about CO1: Recognize consistent and inconsistent systems of linear equations by the row echelonform of the augmented matrix, using rank CO2: Find eigenvalues and corresponding eigenvectors for a square matrix.
	Ordinary Differential Equations	Unit-2	CO4: Understand the genesis of ordinary differential equations.
		Unit 3	CO5: Understand the various techniques of getting exact solutions of solvable first orderdifferential equations and linear differential equations of higher order.
		Unit -4	CO6: Know how to solve linear homogeneous and non-homogeneous equations of higherorder with constant coefficients. CO7: Understand the system of linear differential equations and the solution techniques.
	Vector Calculus	Unit-5	CO7: Understand the concepts on two-dimensional geometry.
Mathematical Tools and Latex (SEC paper)	**Open-Source Mathematical tool**	Unit-1: Introduction to Scilab	CO8: Familiar with open-source mathematical tools.
		Unit 2: Graphical demonstration	CO9: Utilize Scilab for displaying graphs, plots, etc.
	LaTeX	Unit 3: Latex	CO10: Get acquainted with LaTex software CO11: Prepare resume, question paper, project report, etc. using LaTeX

Course Name		Course Content	Course Outcome (CO)
Semester III (NEP) M a j o r C o u r s e			
Real Analysis I	**Real Analysis I**	Unit-1	Students will learn about CO1: Understand the various basic information and importance of the set of real numbers which will help them to build up preliminary ideas about the higher dimensional spaces.
		Unit-2	CO2: Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a sequence.
		Unit-3	CO3: Understand various kinds of standard functions and their graphs and behaviours. CO4: Judge the discontinuities of the real valued functions with the help of the ideas aboutsequences and subsequences. CO5: Enrich their previous knowledge about limits, continuities and differentiability's ofreal valued functions.
		Unit-4	CO6: Expand the different type of functions with the help of appropriate theorem and alsothe remainder term of the expansion.

Abstract Algebra-I and Number Theory	Abstract Algebra-I	Unit-1	CO1: Link the fundamental concepts of groups and symmetries of geometrical objects.
		Unit-2	CO2: Explain the significance of the notions of cosets, normal subgroups, and factor groups.
			CO3: Analyse consequences of Lagrange's theorem.
			CO4: Learn about structure preserving maps between groups and their consequences
	Number Theory	Unit-3	CO5: Learn about some important results in the theory of numbers including the prime number theorem, Chinese remainder theorem, Wilson's theorem and their consequences.
		Unit-4	CO6: Learn about number theoretic functions, modular arithmetic and their applications.
			CO7: Familiarize with modular arithmetic and find primitive roots of prime and composite numbers.
			CO8: Know about open problems in number theory, namely, the Goldbach conjecture and twin-prime conjecture etc.

Course Name		Course Content	Course Outcome (CO)
Real Analysis I	**Real Analysis I**	Unit-1	Students will learn about CO1: Understand the basic concepts and know the basic techniques of differential andintegral calculus of functions of several variables.
		Unit 2:	CO2: Learn conceptual differences while advancing from one variable to several variables incalculus
		Unit 3	CO3: Apply multivariable calculus in various optimization problems. Solve problemsinvolving maxima and minima, line integral and surface integral, and vector calculus. CO4: Visualise the structure of curves and surfaces in plane and space etc. CO5: Learn the applications of multivariable calculus in different fields like Physics,Economics, Medical Sciences, Animation & Computer Graphics etc. CO6: Realize importance of Green, Gauss and Stokes' theorems in other branches ofMathematics.
		Unit -4	CO7: Understand inter-relationship amongst the line integral, double and triple integral formulations. CO8: Develop mathematical maturity to undertake higher level studies in mathematics andrelated fields.

Linear Algebra-II and Tensor Calculus	**Abstract Algebra-II**	Unit-1	CO1: Extend their previous knowledge about matrices and different form of matrixes
		Unit-2	CO2: Understand the concepts of vector spaces, subspaces, bases, dimension and theirproperties
		Unit-3	CO3: Relate matrices and linear transformations, compute eigenvalues and eigenvectors of linear transformations.
		Unit-4	CO 4: Learn properties of inner product spaces and determine orthogonality in inner productspaces.
		Unit-5	CO5: Classify different standard conics and coincided by reducing the equations into itnormal or canonical form with the help of ideas on matrices.
		Unit-6	CO6: Realize the further study of inner product spaces and linear transformations.
	Tensor Calculus	Unit-1	CO7: Explain the basic concepts of tensors.
		Unit-2	CO8: Understand role of tensors in different fields.
C Programming (SEC paper)	**C Programming**	Unit-1	CO1: Acquire knowledge of different computer languages.
		Unit-2	CO2: Understand basic structures, characters, identifier etc. in C language .
		Unit-3	CO3: Write flow chart and corresponding C-program for solving problems requiring decision making, branching, looping and other control statements.
		Unit-4	CO4: Learn to implement arrays and functions in C programming.
		Unit-5	CO5: Familiarise with the concepts of structure, union and pointers.

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Pool of Minor Courses offered by Mathematics Discipline

Course Name		Course Content	Course Outcome (CO)
Classical Algebra, Calculus and Analytical Geometry			**Semester I (NEP)** Minor Course
	Classical Algebra	Unit-1	Students will learn about CO1: Employ De Moivre's theorem in a number of applications to solve numericalproblems.
		Unit-2	CO2: Understand the importance of roots of real and complex polynomials and learn various methods of obtaining roots.
		Unit-3	CO3: Understand basic inequalities including Cauchy- Schwartz inequality, Weierstrass inequality and its application in obtaining maxima-minima
	Calculus	Unit-4	CO4: Understand higher order derivatives, Successive differentiation, Leibnitz rule and its applications, concavity and inflection points, envelopes, asymptotes, Maxima and Minima, Curvature
		Unit-5	CO5: Understand Reduction formulae, derivations and illustrations of reduction formulae for integration of various trigonometric functions. Evaluation of arc length, arc length of parametric curves, areas and volumes of surfaces of revolution.
	Analytical Geometry	Unit-6	CO6: Understand the concepts on two-dimensional geometry.
		Unit-7	CO7: Understand the concepts on three-dimensional geometry.

Course Name	Course Content		Course Outcome (CO)
Linear Algebra I, Ordinary Differential Equations and Vector Calculus	Linear Algebra I	Unit-1	Students will learn about CO1: Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using rank CO2: Find eigenvalues and corresponding eigenvectors for a square matrix.
	Ordinary Differential Equations	Unit-2	CO4: Understand the genesis of ordinary differential equations.
		Unit-3	CO5: Understand the various techniques of getting exact solutions of solvable first orderdifferential equations and linear differential equations of higher order.
		Unit-4	CO6: Know how to solve linear homogeneous and non-homogeneous equations of higherorder with constant coefficients. CO7: Understand the system of linear differential equations and the solution techniques.
	Vector Calculus	Unit-5	CO7: Understand the concepts on two-dimensional geometry.

Course Name		Course Content	Course Outcome (CO)
Real Analysis and Complex Analysis	Real Analysis	Unit-1	Students will learn about CO1: Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and tocalculate their limit superior, limit inferior, and the limit of a sequence.
	and	Unit-2	CO2: Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers. CO3: Understand various kinds of standard functions and their graphs and behaviours.
		Unit-3	CO4: Judge the discontinuities of the real valued functions with the help of the ideas aboutsequences and sub sequences. CO5: Enrich their previous knowledge about limit, continuities and differentiability of realvalued functions.
		Unit 4	CO6: Expand the different types of function with the help of appropriate theorem and alsothe remainder term of the expansion. CO7: Visualize complex numbers as points of $\mathbb{R}^2$ and stereographic projection of complex plane on the Riemann sphere.
		Unit -5	CO8: Understand the significance of differentiability and analyticity of complex functions leading to the Cauchy-Riemann equations.
	Complex Analysis	Unit 6:	CO9: Learn the role of Cauchy-Goursat theorem and Cauchy integral formula in evaluation of contour integrals.

Course Name		Course Content	Course Outcome (CO)
Semester IV(NEP) Minor Course offered by Mathematics Discipline			
Abstract Algebra and Linear Algebra-II	Abstract Algebra	Unit-1	Students will learn about CO1: Link the fundamental concepts of groups and symmetries of geometrical objects.
	And	Unit 2:	CO2: Understand the concepts of different types of groups, rings and field. CO3 : Explain the significance of the notions of normal subgroups and their properties.
	Linear Algebra-II	**Unit 3**	CO4: Extend their previous knowledge about matrices and different form of matrixes
		Unit4	CO5: Understand the concepts of vector spaces, subspaces, bases, dimension and theirproperties
			CO6: Relate matrices and linear transformations, compute eigen values and eigen vectors oflinear transformations.
		Unit 5	CO7: Find different polynomials associated with the matrix of linear transforms
Semester IV(NEP) Minor Course offered by Mathematics Discipline			
	Abstract Algebra	Unit-1	Students will learn about CO1: Link the fundamental concepts of groups and symmetries of geometrical objects.

Pool of Multidisciplinary Courses offered by Mathematics Discipline

Course Name		Course Content	Course Outcome (CO)
Semester I(NEP) MDC			
Business Mathematics (MDC)	Algebra and Didfferential and Integral Calculus	Unit-1 Unit-2	Students will learn about CO1: Learn the concepts of AP and GP Series, logarithm, Permutation & Combination andSet Theory CO2: Learn the concepts of Matrix and determinant. CO3: Understand the concepts of limit, continuity, differentiability and integration of functions.

Course Name		Course Content	Course Outcome (CO)
Semester II(NEP) MDC			
Mathematical Science (MDC)	Algebra and Didfferential and Integral Calculus	Unit-1 Unit-2	Students will learn about CO1: Learn the concepts of AP and GP Series, logarithm, Permutation & Combination andSet Theory CO2: Learn the concepts of Matrix and determinant. CO3: Understand the concepts of limit, continuity, differentiability and integration of functions.

Course Name		Course Content	Course Outcome (CO)
Semester III(NEP) MDC			
Indian Mathematics (MDC)	Indian Mathematics	Unit-1	Students will learn about CO1: Understand the fastest calculations in arithmetic.
		Unit-2	CO2: Understand and learn some of the important mathematical results and techniques given by Indianmathematicians
		Unit-3	CO3: Understand LCM and HCF.
		Unit-4	CO4: Understand and computation of Power and Root.
		Unit-5	CO5: Understand the work of Ancient Indian mathematician.