PROGRAM OUTCOMES

Program: B.A./ B.Sc.; Subject: MATHEMATICS

Session: 2018-- 2019

Mission : The mission of the B.Sc. Hons. in Mathematics under our curriculum is to serve educational needs of our students and, in particular, to offer programs and services that meet the special needs of its diverse student in this metropolitan location. Students are fulfilled with analytic and problem-solving skills for their future careers and further higher studies in post graduate or equivalent other professional course. Mathematics is a subject which is a brainchild of Human Beings and possibly must be treated as a most sophisticated subject amongst all science subjects. So our program for mathematics has been build up so beautifully that a newcomer student can acquire a large amount of information regarding Mathematics. Classes develop student abilities and aptitudes to implement mathematical concepts, methods and ideas not only to solve problems in this subject only but also to tackle problems in various fields such as Physics, computer Science, Statistics, Biology, Economics and many other branches of modern science. Students learn to communicate ideas effectively and to digest new information and concepts independently. Mission of this program is to give students the mathematical knowledge and understanding necessary for successful career in business, industry or Government, teaching mathematics in different educational institution and pursuing further higher studies. The department co-operates fully with the UGC, the university of Burdwan and college authorities in every part of their academic planning and incorporate each and every academic decisions which are eventually helps to build up our knowledge based education system in a more concrete way. The Mathematics program of our college in compliance with the syllabus structured by our Burdwan University promotes mathematical skills and knowledge for their intrinsic beauty, effectiveness in developing proficiency in analytical reasoning, and utility in modeling and solving real world problems.

Students who have learnt to logically question assertions, recognize patterns, and distinguish the essential and irrelevant aspects of problems can think deeply and precisely and share their ideas. Students majoring in Mathematics attain proficiency in critical thinking. The ability to identify reflects upon, evaluate, integrate, and apply different types of information and knowledge to form independent judgments. Analytical and logical thinking and the habit of drawing conclusions based on quantitative information.

Goals: The aims of Mathematics department of Hooghly Women's College is to produce academically sound students who will

- successfully compete and take part in various national and international level examinations.
- understand and use mathematics in other field of knowledge with basic mathematical skills for everyday life.
- be well grounded in the basic theoretical excursions in algebra, geometry and beginning level calculus etc.
- develop and understand the importance of proof which distinguishes mathematics from all other disciplines and will demonstrate proficiency in understanding mathematical philosophy and proofs .
- understand the fundamental axioms in mathematics, and capability of developing ideas based on them.

- develop skills to characterize problems, formulate a hypothesis, evaluate and validate outcomes and draw reasonable conclusions thereof.
- develop the effective scientific and technical communications in both oral and written forms.
- gain exposure to a variety of areas of mathematics and related fields such as computer science, the natural sciences, business and economics.
- understand the historical and contemporary role of mathematics and be able to place the discipline properly in the context of other human intellectual achievement.
- be master enough to know how and when to use concepts, ideas and important results.
- acquire knowledge of the variety of mathematical areas and their interrelation.
- acquire the mathematical knowledge and skills necessary for success in their program of career.
- develop the ability to work both independently and collaboratively on mathematical problems.
- acquire knowledge of the roles of intuition, formalization and proof in mathematics.
- develop problem solving skills
- understand and be able to articulate the differences between inductive and deductive reasoning
- formulate conjectures by abstracting general principles from examples.

Problem solving ability:

Students will be able to

- formulate and solve abstract mathematical problems.
- recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems.
- apply mathematical methodologies to open-ended real-world problems.
- recognize connections between different branches of mathematics
- recognize and appreciate the connections between theory and applications.

Effective communication :

Students will be able to

- present mathematics clearly and precisely to an audience of peers and faculty
- appreciate the role of mathematical proof as a means of conveying mathematical knowledge .
- understand the differences between proofs and other less formal arguments .
- make vague ideas precise by formulating them in mathematical language

- describe mathematical ideas from multiple perspectives .
- explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians.

Critical thinking :

Students will

- understand the basic rules of logic, including the role of axioms or assumptions .
- appreciate the role of mathematical proof in formal deductive reasoning .
- be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life .
- understand and be able to articulate the differences between inductive and deductive reasoning .
- proficiently construct logical arguments and rigorous proofs .
- formulate conjectures by abstracting general principles from examples

COURSE OUTCOMES

B.Sc. (HONOURS), Sub: MATHEMATICS

Session: 2018-- 2019

SEMESTER I

CC-01: Calculus, Geometry and Differential Equations

This course will enable the students to:

- Learn about hyperbolic functions, higher order derivatives using Leibnitz Rule and its applications.
- Trace curves in Cartesian and polar coordinates.
- Develop Reduction formulae for different combination of functions.
- Compute arc length and area of surfaces of revolution by integration.
- Sketch conics in a plane using its mathematical properties in the different coordinate systems of reference.

- Learn concepts in two-dimensional and three-dimensional geometry.
- Classification of conics namely, ellipse, parabola and hyperbola and polar equation of conics.
- Learn about three-dimensional objects such as spheres, cylinders, conicoids, generating lines and classification of quadrics.
- Learn about general, particular, singular solutions and integrating factors of ordinary differential equations.
- Solve the exact, linear and Bernoulli equations.

CC-02: Algebra

After the course, the student will be able to:

- Represent complex numbers in polar form and employ De Moivre's theorem in a number of applications.
- Solve problems of inequalities involving A.M., G.M., H.M.
- Learn about equivalence classes and cardinality of a set.
- Apply division algorithm and mathematical induction to problems.
- Solve system of simultaneous linear equations and its applications.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- Find eigen values and corresponding eigenvectors for a square matrix.

SEMESTER II

CC-03: Real Analysis

This course will enable the students to:

- Understand many properties of the real line, including completeness and Archimedean properties.
- Learn to define sequences in terms of functions from the set of natural numbers to a subset of real number.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

CC-04: Differential Equation and Vector Calculus

This course will enable the students to:

- Solve linear homogeneous and non-homogeneous differential equations of higher order using various techniques.
- Solve system of linear homogeneous differential equations.
- Develop power series solution of differential equation about ordinary and singular points.

- Understand limits, continuity and derivatives of vector-valued functions and their differentiation and integration.
- Use of vector triple products to problems.
-

SEMESTER III

CC-05: Theory of Real Functions and Introduction to Metric Space

After the course, the student will be able to:

- Have a rigorous understanding of the concept of limit of a function.
- Learn about continuity and uniform continuity of functions defined on intervals.
- Understand continuous functions on closed and bounded intervals.
- Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.
- Apply Mean Value Theorems and Taylor's theorem to different problems.
- Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
- Understand various concepts, viz. balls, open set, closed set, limit point, subspace, separable space, etc.

CC-06: Group Theory-I

The course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about Lagrange's theorem and Fermat's Little theorem.
- Know about group homomorphisms and group isomorphisms.

CC-07: Numerical Methods & Numerical Methods Lab

The course will enable the students to:

- Learn some numerical methods to find the roots of nonlinear equations of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- Solve system of linear equations using Gauss Elimination, Gauss Jordan, Gauss Jacobi, Gauss Seidel and LU Decomposition methods.
- Apply Interpolation techniques to compute the values for a tabulated function at points not in the table.
- Apply numerical differentiation and integration formulae for different problems.

- Solve ordinary differential equations numerically using prominent methods like Euler's, Modified Euler's and Runge-Kutta methods.
- Use C Programming technique for 8 different numerical methods.

SEC11: Logic and Sets

The course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc. on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction method.

SEMESTER IV

CC-08: Riemann Integration & Series of Functions

After the course, the student will be able to:

- Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental Theorem of Integral Calculus.
- Know about improper integrals including Beta and Gamma functions and their applications.
- Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence.
- Know about the constraints for the interchangeability of differentiability and integrability with infinite sum.
- Apply Fourier Series expansion for different functions.
- Approximate transcendental functions in terms of power series as well as differentiation and integration of power series.

CC-09: Multivariate Calculus

The course will enable the students to:

- Understand and apply the extension of the studies of single variable differential and integral calculus to functions of two or more independent variables. 4
- Use different vector differential operators such as Gradient, Divergence and Curl to problems.
- Know the application of line and surface integrals, Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

CC-10: Ring Theory & Linear Algebra-I

The course will enable the students to:

- Learn about the fundamental concept of rings, integral domains and fields.
- Know about ring homomorphisms and isomorphisms theorems of rings.

- Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
- Know the basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation and the change of coordinate matrix.

SEC 21: Graph Theory

The course will enable the students to:

• Able to define the basic concepts of graphs, directed graphs and weighted graphs.

• Able to define the properties of bipartite graphs, particularly in trees.

• Able to understand Eulerian and Hamiltonian graphs.

SEMESTER V

CC-11: Partial Differential Equations and Applications

After the course, the student will be able to:

- Formulate, classify and transform first order PDEs into canonical form.
- Learn about method of characteristics and separation of variables to solve first order PDE's.
- Classify and solve second order linear PDEs.
- Learn about Cauchy problem for second order PDE including homogeneous and nonhomogeneous wave equations.
- Apply the method of separation of variables for solving many well-known second order PDEs.

CC-12: Mechanics - I

After the course, the student will be able to:

- Solve different problems of Statics from Coplanar Forces, Forces in 3D, Virtual Work, Stable and Unstable Equilibrium, Equilibrium of Flexible Strings and Centre of Gravity.
- Solve the problems of Particle Dynamics from chapters viz., Simple Harmonic Motion, Central Force, Stability of nearly circular orbits, Motion of Artificial Satellites, Motion when mass varies and Constrained Motion.
- Know the concept of Degrees of freedom, Motion of a system of particles and solve problems of rigid dynamics relating to Moment and Product of Inertia, D' Alembert's Principle, Motion about a fixed axis of rotation and Motion in 2D.

DSE 11 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. Using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.
- Solve the transportation problems, Game problems, assignment problems.

DSE 21 : Probability and statistics

After the course the students will be able to

- Define probability in different ways
- Know about mathematical expectations, distribution function, random variables.
- Learn about probability density and moment generating function.
- Learn about regression lines, Chebyshev's inequality, law of large numbers, Markov chain.
- Know basic concepts of statistics.
- Solve problems regarding probability and statistics.

SEMESTER VI

CC-13: Metric Spaces and Complex Analysis

The completion of the course will enable the students to:

- Know about Sequences in Metric Spaces, Complete Metric Spaces, Continuity, Homomorphism, Contraction mappings, Banach fixed point theorem and its application to ODE.
- Learn about the two important topological properties, namely connectedness and compactness of metric spaces and related theorems.
- Learn the significance of differentiability of complex functions leading to the understanding of Cauchy−Riemann equations.
- Learn analytic functions, evaluation of the contour integrals and convergence ofsequences and series.
- Understand the role of Cauchy−Goursat theorem and the Cauchy integral formula.
- Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

CC-14: Ring Theory and Linear Algebra-II

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

- Appreciate the significance of unique factorization in rings and integral domains.
- Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.
- Compute inner products and determine orthogonality on vector spaces, including Gram−Schmidt orthogonalization process to obtain orthonormal basis.
- Find the adjoint, normal, unitary and orthogonal operators.

DSE 33 : Group Theory II

The completion of this course will enable the students to :

- Understand the concept of automorphism, external direct products.
- Gain the ideas about group actions, stabilizers and kernels, conjugation.

DSE 43 : Mechanics II

This course will enable the students to

- Solve different problems of Newton's laws, equllibrium, language's equation of motion work energy relation.

Also students will offered to take project work instead of Group theory II or Mechanics II.

Mathematics Project work learn the students how to research a topic other than their known topic and how to written this topic. Through this project work the students will be encouraged to pursuing higher studies after completion their graduation.

B.A./B.Sc. (GENERAL) MATHEMATICS

SEMESTER I

CC-1A: Differential Calculus

This course will enable the students to:

- Understand continuity and differentiability in terms of limits.
- Describe asymptotic behaviour in terms of limits involving infinity.
- Use derivatives to explore the behaviour of a given function, locating and classifying its extrema, and graphing the function.
- Understand the importance of Mean Value Theorems.
- Learn about Maclaurin's series expansion of elementary functions

SEMESTER II

CC-1B: Differential Equations

This course will enable the students to:

- Learn basics of differential equations.
- Formulate differential equations for various mathematical models.
- Solve first order linear and non-linear differential equations of higher order using various techniques.

SEMESTER III

CC-1C: Real Analysis

This course will enable the students to:

- Understand the real numbers and their basic properties.
- Be familiar with convergent and Cauchy sequences.
- Test the convergence and divergence of infinite series of real numbers.
- Learn about sequence and series of functions.
- Learn about power series expansion of some elementary functions.

SEC-11: Logic and Sets

This course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction.

SEMESTER IV

CC-1D: Algebra

This course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about the fundamental concept of rings, integral domains and fields.
- Know about ring homomorphisms and isomorphisms theorems of rings.

SEC-21: Vector Calculus

This course will enable the students to:

- Learn to define vector equation of lines and planes.
- Analyze vector functions to find limit, derivatives, tangent lines etc.
- Compute limits and derivatives of functions of two and three variables.
- Determine divergence, curl of vectors.

SEMESTER V

DSE-1A3 : Linear algebra

This course will enable the students to

- Learns about definition of Vector space and its various examples, subspace and dimension of spaces.
- Learn about linear independence and linear dependence.
- Learn about linear transformation, range and kernels of linear transformation, dual, double dual.
- Learn about characteristics polynomial, eigen value, eigen vector of linear transformation.
- Know about isomorphism theorems.

SEC-31: Probability and Statistics

This course will enable the students to:

- Learn about probability density and moment generating functions.
- Know about various univariate distributions such as Bernoulli, Binomial, Poisson, Gamma and Exponential distributions.
- Learn about distributions to study the joint behaviour of two random variables.

SEMESTER VI

DSE-1B3 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.

SEC-42: Transportation and Game Theory

This course will enable the students to:

- Solve the transportation and assignment problems.
- Learn about the solution of rectangular games using graphical method and using the solution of a pair of associated primal-dual linear programming problems.

PROGRAM OUTCOMES

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Session: 2019-- 2020

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- acquire knowledge of the roles of intuition, formalization and proof in mathematics.
- develop problem solving skills
- understand and be able to articulate the differences between inductive and deductive reasoning
- formulate conjectures by abstracting general principles from examples.

Problem solving ability:

Students will be able to

- formulate and solve abstract mathematical problems.
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Students will

- understand the basic rules of logic, including the role of axioms or assumptions .
- appreciate the role of mathematical proof in formal deductive reasoning .
- be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life .
- understand and be able to articulate the differences between inductive and deductive reasoning .
- proficiently construct logical arguments and rigorous proofs .
- formulate conjectures by abstracting general principles from examples

COURSE OUTCOMES

B.Sc. (HONOURS), Sub: MATHEMATICS

Session: 2019-- 2020

SEMESTER I

CC-01: Calculus, Geometry and Differential Equations

This course will enable the students to:

- Learn about hyperbolic functions, higher order derivatives using Leibnitz Rule and its applications.
- Trace curves in Cartesian and polar coordinates.
- Develop Reduction formulae for different combination of functions.
- Compute arc length and area of surfaces of revolution by integration.
- Sketch conics in a plane using its mathematical properties in the different coordinate systems of reference.

- Learn concepts in two-dimensional and three-dimensional geometry.
- Classification of conics namely, ellipse, parabola and hyperbola and polar equation of conics.
- Learn about three-dimensional objects such as spheres, cylinders, conicoids, generating lines and classification of quadrics.
- Learn about general, particular, singular solutions and integrating factors of ordinary differential equations.
- Solve the exact, linear and Bernoulli equations.

CC-02: Algebra

After the course, the student will be able to:

- Represent complex numbers in polar form and employ De Moivre's theorem in a number of applications.
- Solve problems of inequalities involving A.M., G.M., H.M.
- Learn about equivalence classes and cardinality of a set.
- Apply division algorithm and mathematical induction to problems.
- Solve system of simultaneous linear equations and its applications.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- Find eigen values and corresponding eigenvectors for a square matrix.

SEMESTER II

CC-03: Real Analysis

This course will enable the students to:

- Understand many properties of the real line, including completeness and Archimedean properties.
- Learn to define sequences in terms of functions from the set of natural numbers to a subset of real number.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

CC-04: Differential Equation and Vector Calculus

This course will enable the students to:

- Solve linear homogeneous and non-homogeneous differential equations of higher order using various techniques.
- Solve system of linear homogeneous differential equations.
- Develop power series solution of differential equation about ordinary and singular points.

- Understand limits, continuity and derivatives of vector-valued functions and their differentiation and integration.
- Use of vector triple products to problems.
-

SEMESTER III

CC-05: Theory of Real Functions and Introduction to Metric Space

After the course, the student will be able to:

- Have a rigorous understanding of the concept of limit of a function.
- Learn about continuity and uniform continuity of functions defined on intervals.
- Understand continuous functions on closed and bounded intervals.
- Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.
- Apply Mean Value Theorems and Taylor's theorem to different problems.
- Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
- Understand various concepts, viz. balls, open set, closed set, limit point, subspace, separable space, etc.

CC-06: Group Theory-I

The course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about Lagrange's theorem and Fermat's Little theorem.
- Know about group homomorphisms and group isomorphisms.

CC-07: Numerical Methods & Numerical Methods Lab

The course will enable the students to:

- Learn some numerical methods to find the roots of nonlinear equations of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- Solve system of linear equations using Gauss Elimination, Gauss Jordan, Gauss Jacobi, Gauss Seidel and LU Decomposition methods.
- Apply Interpolation techniques to compute the values for a tabulated function at points not in the table.
- Apply numerical differentiation and integration formulae for different problems.

- Solve ordinary differential equations numerically using prominent methods like Euler's, Modified Euler's and Runge-Kutta methods.
- Use C Programming technique for 8 different numerical methods.

SEC11: Logic and Sets

The course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc. on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction method.

SEMESTER IV

CC-08: Riemann Integration & Series of Functions

After the course, the student will be able to:

- Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental Theorem of Integral Calculus.
- Know about improper integrals including Beta and Gamma functions and their applications.
- Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence.
- Know about the constraints for the interchangeability of differentiability and integrability with infinite sum.
- Apply Fourier Series expansion for different functions.
- Approximate transcendental functions in terms of power series as well as differentiation and integration of power series.

CC-09: Multivariate Calculus

The course will enable the students to:

- Understand and apply the extension of the studies of single variable differential and integral calculus to functions of two or more independent variables. 4
- Use different vector differential operators such as Gradient, Divergence and Curl to problems.
- Know the application of line and surface integrals, Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

CC-10: Ring Theory & Linear Algebra-I

The course will enable the students to:

- Learn about the fundamental concept of rings, integral domains and fields.
- Know about ring homomorphisms and isomorphisms theorems of rings.

- Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
- Know the basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation and the change of coordinate matrix.

SEC 21: Graph Theory

The course will enable the students to:

• Able to define the basic concepts of graphs, directed graphs and weighted graphs.

• Able to define the properties of bipartite graphs, particularly in trees.

• Able to understand Eulerian and Hamiltonian graphs.

SEMESTER V

CC-11: Partial Differential Equations and Applications

After the course, the student will be able to:

- Formulate, classify and transform first order PDEs into canonical form.
- Learn about method of characteristics and separation of variables to solve first order PDE's.
- Classify and solve second order linear PDEs.
- Learn about Cauchy problem for second order PDE including homogeneous and nonhomogeneous wave equations.
- Apply the method of separation of variables for solving many well-known second order PDEs.

CC-12: Mechanics - I

After the course, the student will be able to:

- Solve different problems of Statics from Coplanar Forces, Forces in 3D, Virtual Work, Stable and Unstable Equilibrium, Equilibrium of Flexible Strings and Centre of Gravity.
- Solve the problems of Particle Dynamics from chapters viz., Simple Harmonic Motion, Central Force, Stability of nearly circular orbits, Motion of Artificial Satellites, Motion when mass varies and Constrained Motion.
- Know the concept of Degrees of freedom, Motion of a system of particles and solve problems of rigid dynamics relating to Moment and Product of Inertia, D' Alembert's Principle, Motion about a fixed axis of rotation and Motion in 2D.

DSE 11 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. Using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.
- Solve the transportation problems, Game problems, assignment problems.

DSE 21 : Probability and statistics

After the course the students will be able to

- Define probability in different ways
- Know about mathematical expectations, distribution function, random variables.
- Learn about probability density and moment generating function.
- Learn about regression lines, Chebyshev's inequality, law of large numbers, Markov chain.
- Know basic concepts of statistics.
- Solve problems regarding probability and statistics.

SEMESTER VI

CC-13: Metric Spaces and Complex Analysis

The completion of the course will enable the students to:

- Know about Sequences in Metric Spaces, Complete Metric Spaces, Continuity, Homomorphism, Contraction mappings, Banach fixed point theorem and its application to ODE.
- Learn about the two important topological properties, namely connectedness and compactness of metric spaces and related theorems.
- Learn the significance of differentiability of complex functions leading to the understanding of Cauchy−Riemann equations.
- Learn analytic functions, evaluation of the contour integrals and convergence ofsequences and series.
- Understand the role of Cauchy−Goursat theorem and the Cauchy integral formula.
- Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

CC-14: Ring Theory and Linear Algebra-II

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

- Appreciate the significance of unique factorization in rings and integral domains.
- Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.
- Compute inner products and determine orthogonality on vector spaces, including Gram−Schmidt orthogonalization process to obtain orthonormal basis.
- Find the adjoint, normal, unitary and orthogonal operators.

DSE 33 : Group Theory II

The completion of this course will enable the students to :

- Understand the concept of automorphism, external direct products.
- Gain the ideas about group actions, stabilizers and kernels, conjugation.

DSE 43 : Mechanics II

This course will enable the students to

- Solve different problems of Newton's laws, equllibrium, language's equation of motion work energy relation.

Also students will offered to take project work instead of Group theory II or Mechanics II.

Mathematics Project work learn the students how to research a topic other than their known topic and how to written this topic. Through this project work the students will be encouraged to pursuing higher studies after completion their graduation.

B.A./B.Sc. (GENERAL) MATHEMATICS

SEMESTER I

CC-1A: Differential Calculus

This course will enable the students to:

- Understand continuity and differentiability in terms of limits.
- Describe asymptotic behaviour in terms of limits involving infinity.
- Use derivatives to explore the behaviour of a given function, locating and classifying its extrema, and graphing the function.
- Understand the importance of Mean Value Theorems.
- Learn about Maclaurin's series expansion of elementary functions

SEMESTER II

CC-1B: Differential Equations

This course will enable the students to:

- Learn basics of differential equations.
- Formulate differential equations for various mathematical models.
- Solve first order linear and non-linear differential equations of higher order using various techniques.

SEMESTER III

CC-1C: Real Analysis

This course will enable the students to:

- Understand the real numbers and their basic properties.
- Be familiar with convergent and Cauchy sequences.
- Test the convergence and divergence of infinite series of real numbers.
- Learn about sequence and series of functions.
- Learn about power series expansion of some elementary functions.

SEC-11: Logic and Sets

This course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction.

SEMESTER IV

CC-1D: Algebra

This course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about the fundamental concept of rings, integral domains and fields.
- Know about ring homomorphisms and isomorphisms theorems of rings.

SEC-21: Vector Calculus

This course will enable the students to:

- Learn to define vector equation of lines and planes.
- Analyze vector functions to find limit, derivatives, tangent lines etc.
- Compute limits and derivatives of functions of two and three variables.
- Determine divergence, curl of vectors.

SEMESTER V

DSE-1A3 : Linear algebra

This course will enable the students to

- Learns about definition of Vector space and its various examples, subspace and dimension of spaces.
- Learn about linear independence and linear dependence.
- Learn about linear transformation, range and kernels of linear transformation, dual, double dual.
- Learn about characteristics polynomial, eigen value, eigen vector of linear transformation.
- Know about isomorphism theorems.

SEC-31: Probability and Statistics

This course will enable the students to:

- Learn about probability density and moment generating functions.
- Know about various univariate distributions such as Bernoulli, Binomial, Poisson, Gamma and Exponential distributions.
- Learn about distributions to study the joint behaviour of two random variables.

SEMESTER VI

DSE-1B3 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.

SEC-42: Transportation and Game Theory

This course will enable the students to:

- Solve the transportation and assignment problems.
- Learn about the solution of rectangular games using graphical method and using the solution of a pair of associated primal-dual linear programming problems.

PROGRAM OUTCOMES

Program: B.A./ B.Sc.; Subject: MATHEMATICS

Session: 2020-- 2021

Mission : The mission of the B.Sc. Hons. in Mathematics under our curriculum is to serve educational needs of our students and, in particular, to offer programs and services that meet the special needs of its diverse student in this metropolitan location. Students are fulfilled with analytic and problem solving skills for their future careers and further higher studies in post graduate or equivalent other professional course. Mathematics is a subject which is a brainchild of Human Beings and possibly must be treated as a most sophisticated subject amongst all science subjects. So our program for mathematics has been build up so beautifully that a newcomer student can acquire a large amount of information regarding Mathematics. Classes develop student abilities and aptitudes to implement mathematical concepts, methods and ideas not only to solve problems in this subject only but also to tackle problems in various fields such as Physics, computer Science, Statistics, Biology, Economics and many other branches of modern science. Students learn to communicate ideas effectively and to digest new information and concepts independently. Mission of this program is to give students the mathematical knowledge and understanding necessary for successful career in business, industry or Government, teaching mathematics in different educational institution and pursuing further higher studies. The department co-operates fully with the UGC, the university of Burdwan and college authorities in every part of their academic planning and incorporate each and every academic decisions which are eventually helps to build up our knowledge based education system in a more concrete way. The Mathematics program of our college in compliance with the syllabus structured by our Burdwan University promotes mathematical skills and knowledge for their intrinsic beauty, effectiveness in developing proficiency in analytical reasoning, and utility in modeling and solving real world problems.

Students who have learnt to logically question assertions, recognize patterns, and distinguish the essential and irrelevant aspects of problems can think deeply and precisely and share their ideas. Students majoring in Mathematics attain proficiency in critical thinking. The ability to identify reflects upon, evaluate, integrate, and apply different types of information and knowledge to form independent judgments. Analytical and logical thinking and the habit of drawing conclusions based on quantitative information.

Goals: The aims of Mathematics department of Hooghly Women's College is to produce academically sound students who will

- successfully compete and take part in various national and international level examinations.
- understand and use mathematics in other field of knowledge with basic mathematical skills for everyday life.
- be well grounded in the basic theoretical excursions in algebra, geometry and beginning level calculus etc.
- develop and understand the importance of proof which distinguishes mathematics from all other disciplines and will demonstrate proficiency in understanding mathematical philosophy and proofs .
- understand the fundamental axioms in mathematics, and capability of developing ideas based on them.

- develop skills to characterize problems, formulate a hypothesis, evaluate and validate outcomes and draw reasonable conclusions thereof.
- develop the effective scientific and technical communications in both oral and written forms.
- gain exposure to a variety of areas of mathematics and related fields such as computer science, the natural sciences, business and economics.
- understand the historical and contemporary role of mathematics and be able to place the discipline properly in the context of other human intellectual achievement.
- be master enough to know how and when to use concepts, ideas and important results.
- acquire knowledge of the variety of mathematical areas and their interrelation.
- acquire the mathematical knowledge and skills necessary for success in their program of career.
- develop the ability to work both independently and collaboratively on mathematical problems.
- acquire knowledge of the roles of intuition, formalization and proof in mathematics.
- develop problem solving skills
- understand and be able to articulate the differences between inductive and deductive reasoning
- formulate conjectures by abstracting general principles from examples.

Problem solving ability:

Students will be able to

- formulate and solve abstract mathematical problems.
- recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems.
- apply mathematical methodologies to open-ended real-world problems.
- recognize connections between different branches of mathematics
- recognize and appreciate the connections between theory and applications.

Effective communication :

Students will be able to

- present mathematics clearly and precisely to an audience of peers and faculty
- appreciate the role of mathematical proof as a means of conveying mathematical knowledge .
- understand the differences between proofs and other less formal arguments .
- make vague ideas precise by formulating them in mathematical language

- describe mathematical ideas from multiple perspectives .
- explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians.

Critical thinking :

Students will

- understand the basic rules of logic, including the role of axioms or assumptions .
- appreciate the role of mathematical proof in formal deductive reasoning .
- be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life .
- understand and be able to articulate the differences between inductive and deductive reasoning .
- proficiently construct logical arguments and rigorous proofs .
- formulate conjectures by abstracting general principles from examples

COURSE OUTCOMES

B.Sc. (HONOURS), Sub: MATHEMATICS

Session: 2020-- 2021

SEMESTER I

CC-01: Calculus, Geometry and Differential Equations

This course will enable the students to:

- Learn about hyperbolic functions, higher order derivatives using Leibnitz Rule and its applications.
- Trace curves in Cartesian and polar coordinates.
- Develop Reduction formulae for different combination of functions.
- Compute arc length and area of surfaces of revolution by integration.
- Sketch conics in a plane using its mathematical properties in the different coordinate systems of reference.

- Learn concepts in two-dimensional and three-dimensional geometry.
- Classification of conics namely, ellipse, parabola and hyperbola and polar equation of conics.
- Learn about three-dimensional objects such as spheres, cylinders, conicoids, generating lines and classification of quadrics.
- Learn about general, particular, singular solutions and integrating factors of ordinary differential equations.
- Solve the exact, linear and Bernoulli equations.

CC-02: Algebra

After the course, the student will be able to:

- Represent complex numbers in polar form and employ De Moivre's theorem in a number of applications.
- Solve problems of inequalities involving A.M., G.M., H.M.
- Learn about equivalence classes and cardinality of a set.
- Apply division algorithm and mathematical induction to problems.
- Solve system of simultaneous linear equations and its applications.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- Find eigen values and corresponding eigenvectors for a square matrix.

SEMESTER II

CC-03: Real Analysis

This course will enable the students to:

- Understand many properties of the real line, including completeness and Archimedean properties.
- Learn to define sequences in terms of functions from the set of natural numbers to a subset of real number.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

CC-04: Differential Equation and Vector Calculus

This course will enable the students to:

- Solve linear homogeneous and non-homogeneous differential equations of higher order using various techniques.
- Solve system of linear homogeneous differential equations.
- Develop power series solution of differential equation about ordinary and singular points.

- Understand limits, continuity and derivatives of vector-valued functions and their differentiation and integration.
- Use of vector triple products to problems.
-

SEMESTER III

CC-05: Theory of Real Functions and Introduction to Metric Space

After the course, the student will be able to:

- Have a rigorous understanding of the concept of limit of a function.
- Learn about continuity and uniform continuity of functions defined on intervals.
- Understand continuous functions on closed and bounded intervals.
- Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.
- Apply Mean Value Theorems and Taylor's theorem to different problems.
- Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
- Understand various concepts, viz. balls, open set, closed set, limit point, subspace, separable space, etc.

CC-06: Group Theory-I

The course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about Lagrange's theorem and Fermat's Little theorem.
- Know about group homomorphisms and group isomorphisms.

CC-07: Numerical Methods & Numerical Methods Lab

The course will enable the students to:

- Learn some numerical methods to find the roots of nonlinear equations of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- Solve system of linear equations using Gauss Elimination, Gauss Jordan, Gauss Jacobi, Gauss Seidel and LU Decomposition methods.
- Apply Interpolation techniques to compute the values for a tabulated function at points not in the table.
- Apply numerical differentiation and integration formulae for different problems.

- Solve ordinary differential equations numerically using prominent methods like Euler's, Modified Euler's and Runge-Kutta methods.
- Use C Programming technique for 8 different numerical methods.

SEC11: Logic and Sets

The course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc. on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction method.

SEMESTER IV

CC-08: Riemann Integration & Series of Functions

After the course, the student will be able to:

- Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental Theorem of Integral Calculus.
- Know about improper integrals including Beta and Gamma functions and their applications.
- Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence.
- Know about the constraints for the interchangeability of differentiability and integrability with infinite sum.
- Apply Fourier Series expansion for different functions.
- Approximate transcendental functions in terms of power series as well as differentiation and integration of power series.

CC-09: Multivariate Calculus

The course will enable the students to:

- Understand and apply the extension of the studies of single variable differential and integral calculus to functions of two or more independent variables. 4
- Use different vector differential operators such as Gradient, Divergence and Curl to problems.
- Know the application of line and surface integrals, Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

CC-10: Ring Theory & Linear Algebra-I

The course will enable the students to:

- Learn about the fundamental concept of rings, integral domains and fields.
- Know about ring homomorphisms and isomorphisms theorems of rings.

- Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
- Know the basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation and the change of coordinate matrix.

SEC 21: Graph Theory

The course will enable the students to:

• Able to define the basic concepts of graphs, directed graphs and weighted graphs.

• Able to define the properties of bipartite graphs, particularly in trees.

• Able to understand Eulerian and Hamiltonian graphs.

SEMESTER V

CC-11: Partial Differential Equations and Applications

After the course, the student will be able to:

- Formulate, classify and transform first order PDEs into canonical form.
- Learn about method of characteristics and separation of variables to solve first order PDE's.
- Classify and solve second order linear PDEs.
- Learn about Cauchy problem for second order PDE including homogeneous and nonhomogeneous wave equations.
- Apply the method of separation of variables for solving many well-known second order PDEs.

CC-12: Mechanics - I

After the course, the student will be able to:

- Solve different problems of Statics from Coplanar Forces, Forces in 3D, Virtual Work, Stable and Unstable Equilibrium, Equilibrium of Flexible Strings and Centre of Gravity.
- Solve the problems of Particle Dynamics from chapters viz., Simple Harmonic Motion, Central Force, Stability of nearly circular orbits, Motion of Artificial Satellites, Motion when mass varies and Constrained Motion.
- Know the concept of Degrees of freedom, Motion of a system of particles and solve problems of rigid dynamics relating to Moment and Product of Inertia, D' Alembert's Principle, Motion about a fixed axis of rotation and Motion in 2D.

DSE 11 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. Using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.
- Solve the transportation problems, Game problems, assignment problems.

DSE 21 : Probability and statistics

After the course the students will be able to

- Define probability in different ways
- Know about mathematical expectations, distribution function, random variables.
- Learn about probability density and moment generating function.
- Learn about regression lines, Chebyshev's inequality, law of large numbers, Markov chain.
- Know basic concepts of statistics.
- Solve problems regarding probability and statistics.

SEMESTER VI

CC-13: Metric Spaces and Complex Analysis

The completion of the course will enable the students to:

- Know about Sequences in Metric Spaces, Complete Metric Spaces, Continuity, Homomorphism, Contraction mappings, Banach fixed point theorem and its application to ODE.
- Learn about the two important topological properties, namely connectedness and compactness of metric spaces and related theorems.
- Learn the significance of differentiability of complex functions leading to the understanding of Cauchy−Riemann equations.
- Learn analytic functions, evaluation of the contour integrals and convergence ofsequences and series.
- Understand the role of Cauchy−Goursat theorem and the Cauchy integral formula.
- Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

CC-14: Ring Theory and Linear Algebra-II

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

- Appreciate the significance of unique factorization in rings and integral domains.
- Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.
- Compute inner products and determine orthogonality on vector spaces, including Gram−Schmidt orthogonalization process to obtain orthonormal basis.
- Find the adjoint, normal, unitary and orthogonal operators.

DSE 33 : Group Theory II

The completion of this course will enable the students to :

- Understand the concept of automorphism, external direct products.
- Gain the ideas about group actions, stabilizers and kernels, conjugation.

DSE 43 : Mechanics II

This course will enable the students to

- Solve different problems of Newton's laws, equllibrium, language's equation of motion work energy relation.

Also students will offered to take project work instead of Group theory II or Mechanics II.

Mathematics Project work learn the students how to research a topic other than their known topic and how to written this topic. Through this project work the students will be encouraged to pursuing higher studies after completion their graduation.

B.A./B.Sc. (GENERAL) MATHEMATICS

SEMESTER I

CC-1A: Differential Calculus

This course will enable the students to:

- Understand continuity and differentiability in terms of limits.
- Describe asymptotic behaviour in terms of limits involving infinity.
- Use derivatives to explore the behaviour of a given function, locating and classifying its extrema, and graphing the function.
- Understand the importance of Mean Value Theorems.
- Learn about Maclaurin's series expansion of elementary functions

SEMESTER II

CC-1B: Differential Equations

This course will enable the students to:

- Learn basics of differential equations.
- Formulate differential equations for various mathematical models.
- Solve first order linear and non-linear differential equations of higher order using various techniques.

SEMESTER III

CC-1C: Real Analysis

This course will enable the students to:

- Understand the real numbers and their basic properties.
- Be familiar with convergent and Cauchy sequences.
- Test the convergence and divergence of infinite series of real numbers.
- Learn about sequence and series of functions.
- Learn about power series expansion of some elementary functions.

SEC-11: Logic and Sets

This course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction.

SEMESTER IV

CC-1D: Algebra

This course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
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- Analyze vector functions to find limit, derivatives, tangent lines etc.
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SEMESTER V

DSE-1A3 : Linear algebra

This course will enable the students to

- Learns about definition of Vector space and its various examples, subspace and dimension of spaces.
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This course will enable the students to:

- Learn about probability density and moment generating functions.
- Know about various univariate distributions such as Bernoulli, Binomial, Poisson, Gamma and Exponential distributions.
- Learn about distributions to study the joint behaviour of two random variables.

SEMESTER VI

DSE-1B3 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.

SEC-42: Transportation and Game Theory

This course will enable the students to:

- Solve the transportation and assignment problems.
- Learn about the solution of rectangular games using graphical method and using the solution of a pair of associated primal-dual linear programming problems.

PROGRAM OUTCOMES

Program: B.A./ B.Sc.; Subject: MATHEMATICS

Session: 2021-- 2022

Mission : The mission of the B.Sc. Hons. in Mathematics under our curriculum is to serve educational needs of our students and, in particular, to offer programs and services that meet the special needs of its diverse student in this metropolitan location. Students are fulfilled with analytic and problem solving skills for their future careers and further higher studies in post graduate or equivalent other professional course. Mathematics is a subject which is a brainchild of Human Beings and possibly must be treated as a most sophisticated subject amongst all science subjects. So our program for mathematics has been build up so beautifully that a newcomer student can acquire a large amount of information regarding Mathematics. Classes develop student abilities and aptitudes to implement mathematical concepts, methods and ideas not only to solve problems in this subject only but also to tackle problems in various fields such as Physics, computer Science, Statistics, Biology, Economics and many other branches of modern science. Students learn to communicate ideas effectively and to digest new information and concepts independently. Mission of this program is to give students the mathematical knowledge and understanding necessary for successful career in business, industry or Government, teaching mathematics in different educational institution and pursuing further higher studies. The department co-operates fully with the UGC, the university of Burdwan and college authorities in every part of their academic planning and incorporate each and every academic decisions which are eventually helps to build up our knowledge based education system in a more concrete way. The Mathematics program of our college in compliance with the syllabus structured by our Burdwan University promotes mathematical skills and knowledge for their intrinsic beauty, effectiveness in developing proficiency in analytical reasoning, and utility in modeling and solving real world problems.

Students who have learnt to logically question assertions, recognize patterns, and distinguish the essential and irrelevant aspects of problems can think deeply and precisely and share their ideas. Students majoring in Mathematics attain proficiency in critical thinking. The ability to identify reflects upon, evaluate, integrate, and apply different types of information and knowledge to form independent judgments. Analytical and logical thinking and the habit of drawing conclusions based on quantitative information.

Goals: The aims of Mathematics department of Hooghly Women's College is to produce academically sound students who will

- successfully compete and take part in various national and international level examinations.
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- develop and understand the importance of proof which distinguishes mathematics from all other disciplines and will demonstrate proficiency in understanding mathematical philosophy and proofs .
- understand the fundamental axioms in mathematics, and capability of developing ideas based on them.

- develop skills to characterize problems, formulate a hypothesis, evaluate and validate outcomes and draw reasonable conclusions thereof.
- develop the effective scientific and technical communications in both oral and written forms.
- gain exposure to a variety of areas of mathematics and related fields such as computer science, the natural sciences, business and economics.
- understand the historical and contemporary role of mathematics and be able to place the discipline properly in the context of other human intellectual achievement.
- be master enough to know how and when to use concepts, ideas and important results.
- acquire knowledge of the variety of mathematical areas and their interrelation.
- acquire the mathematical knowledge and skills necessary for success in their program of career.
- develop the ability to work both independently and collaboratively on mathematical problems.
- acquire knowledge of the roles of intuition, formalization and proof in mathematics.
- develop problem solving skills
- understand and be able to articulate the differences between inductive and deductive reasoning
- formulate conjectures by abstracting general principles from examples.

Problem solving ability:

Students will be able to

- formulate and solve abstract mathematical problems.
- recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems.
- apply mathematical methodologies to open-ended real-world problems.
- recognize connections between different branches of mathematics
- recognize and appreciate the connections between theory and applications.

Effective communication :

Students will be able to

- present mathematics clearly and precisely to an audience of peers and faculty
- appreciate the role of mathematical proof as a means of conveying mathematical knowledge .
- understand the differences between proofs and other less formal arguments .
- make vague ideas precise by formulating them in mathematical language

- describe mathematical ideas from multiple perspectives .
- explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians.

Critical thinking :

Students will

- understand the basic rules of logic, including the role of axioms or assumptions .
- appreciate the role of mathematical proof in formal deductive reasoning .
- be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life .
- understand and be able to articulate the differences between inductive and deductive reasoning .
- proficiently construct logical arguments and rigorous proofs .
- formulate conjectures by abstracting general principles from examples

COURSE OUTCOMES

B.Sc. (HONOURS), Sub: MATHEMATICS

Session: 2021-- 2022

SEMESTER I

CC-01: Calculus, Geometry and Differential Equations

This course will enable the students to:

- Learn about hyperbolic functions, higher order derivatives using Leibnitz Rule and its applications.
- Trace curves in Cartesian and polar coordinates.
- Develop Reduction formulae for different combination of functions.
- Compute arc length and area of surfaces of revolution by integration.
- Sketch conics in a plane using its mathematical properties in the different coordinate systems of reference.

- Learn concepts in two-dimensional and three-dimensional geometry.
- Classification of conics namely, ellipse, parabola and hyperbola and polar equation of conics.
- Learn about three-dimensional objects such as spheres, cylinders, conicoids, generating lines and classification of quadrics.
- Learn about general, particular, singular solutions and integrating factors of ordinary differential equations.
- Solve the exact, linear and Bernoulli equations.

CC-02: Algebra

After the course, the student will be able to:

- Represent complex numbers in polar form and employ De Moivre's theorem in a number of applications.
- Solve problems of inequalities involving A.M., G.M., H.M.
- Learn about equivalence classes and cardinality of a set.
- Apply division algorithm and mathematical induction to problems.
- Solve system of simultaneous linear equations and its applications.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- Find eigen values and corresponding eigenvectors for a square matrix.

SEMESTER II

CC-03: Real Analysis

This course will enable the students to:

- Understand many properties of the real line, including completeness and Archimedean properties.
- Learn to define sequences in terms of functions from the set of natural numbers to a subset of real number.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

CC-04: Differential Equation and Vector Calculus

This course will enable the students to:

- Solve linear homogeneous and non-homogeneous differential equations of higher order using various techniques.
- Solve system of linear homogeneous differential equations.
- Develop power series solution of differential equation about ordinary and singular points.

- Understand limits, continuity and derivatives of vector-valued functions and their differentiation and integration.
- Use of vector triple products to problems.
-

SEMESTER III

CC-05: Theory of Real Functions and Introduction to Metric Space

After the course, the student will be able to:

- Have a rigorous understanding of the concept of limit of a function.
- Learn about continuity and uniform continuity of functions defined on intervals.
- Understand continuous functions on closed and bounded intervals.
- Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.
- Apply Mean Value Theorems and Taylor's theorem to different problems.
- Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
- Understand various concepts, viz. balls, open set, closed set, limit point, subspace, separable space, etc.

CC-06: Group Theory-I

The course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about Lagrange's theorem and Fermat's Little theorem.
- Know about group homomorphisms and group isomorphisms.

CC-07: Numerical Methods & Numerical Methods Lab

The course will enable the students to:

- Learn some numerical methods to find the roots of nonlinear equations of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- Solve system of linear equations using Gauss Elimination, Gauss Jordan, Gauss Jacobi, Gauss Seidel and LU Decomposition methods.
- Apply Interpolation techniques to compute the values for a tabulated function at points not in the table.
- Apply numerical differentiation and integration formulae for different problems.

- Solve ordinary differential equations numerically using prominent methods like Euler's, Modified Euler's and Runge-Kutta methods.
- Use C Programming technique for 8 different numerical methods.

SEC11: Logic and Sets

The course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc. on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction method.

SEMESTER IV

CC-08: Riemann Integration & Series of Functions

After the course, the student will be able to:

- Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental Theorem of Integral Calculus.
- Know about improper integrals including Beta and Gamma functions and their applications.
- Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence.
- Know about the constraints for the interchangeability of differentiability and integrability with infinite sum.
- Apply Fourier Series expansion for different functions.
- Approximate transcendental functions in terms of power series as well as differentiation and integration of power series.

CC-09: Multivariate Calculus

The course will enable the students to:

- Understand and apply the extension of the studies of single variable differential and integral calculus to functions of two or more independent variables. 4
- Use different vector differential operators such as Gradient, Divergence and Curl to problems.
- Know the application of line and surface integrals, Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

CC-10: Ring Theory & Linear Algebra-I

The course will enable the students to:

- Learn about the fundamental concept of rings, integral domains and fields.
- Know about ring homomorphisms and isomorphisms theorems of rings.

- Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.
- Know the basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation and the change of coordinate matrix.

SEC 21: Graph Theory

The course will enable the students to:

• Able to define the basic concepts of graphs, directed graphs and weighted graphs.

• Able to define the properties of bipartite graphs, particularly in trees.

• Able to understand Eulerian and Hamiltonian graphs.

SEMESTER V

CC-11: Partial Differential Equations and Applications

After the course, the student will be able to:

- Formulate, classify and transform first order PDEs into canonical form.
- Learn about method of characteristics and separation of variables to solve first order PDE's.
- Classify and solve second order linear PDEs.
- Learn about Cauchy problem for second order PDE including homogeneous and nonhomogeneous wave equations.
- Apply the method of separation of variables for solving many well-known second order PDEs.

CC-12: Mechanics - I

After the course, the student will be able to:

- Solve different problems of Statics from Coplanar Forces, Forces in 3D, Virtual Work, Stable and Unstable Equilibrium, Equilibrium of Flexible Strings and Centre of Gravity.
- Solve the problems of Particle Dynamics from chapters viz., Simple Harmonic Motion, Central Force, Stability of nearly circular orbits, Motion of Artificial Satellites, Motion when mass varies and Constrained Motion.
- Know the concept of Degrees of freedom, Motion of a system of particles and solve problems of rigid dynamics relating to Moment and Product of Inertia, D' Alembert's Principle, Motion about a fixed axis of rotation and Motion in 2D.

DSE 11 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. Using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.
- Solve the transportation problems, Game problems, assignment problems.

DSE 21 : Probability and statistics

After the course the students will be able to

- Define probability in different ways
- Know about mathematical expectations, distribution function, random variables.
- Learn about probability density and moment generating function.
- Learn about regression lines, Chebyshev's inequality, law of large numbers, Markov chain.
- Know basic concepts of statistics.
- Solve problems regarding probability and statistics.

SEMESTER VI

CC-13: Metric Spaces and Complex Analysis

The completion of the course will enable the students to:

- Know about Sequences in Metric Spaces, Complete Metric Spaces, Continuity, Homomorphism, Contraction mappings, Banach fixed point theorem and its application to ODE.
- Learn about the two important topological properties, namely connectedness and compactness of metric spaces and related theorems.
- Learn the significance of differentiability of complex functions leading to the understanding of Cauchy−Riemann equations.
- Learn analytic functions, evaluation of the contour integrals and convergence ofsequences and series.
- Understand the role of Cauchy−Goursat theorem and the Cauchy integral formula.
- Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

CC-14: Ring Theory and Linear Algebra-II

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

- Appreciate the significance of unique factorization in rings and integral domains.
- Compute the characteristic polynomial, eigenvalues, eigenvectors, and eigenspaces, as well as the geometric and the algebraic multiplicities of an eigenvalue and apply the basic diagonalization result.
- Compute inner products and determine orthogonality on vector spaces, including Gram−Schmidt orthogonalization process to obtain orthonormal basis.
- Find the adjoint, normal, unitary and orthogonal operators.

DSE 33 : Group Theory II

The completion of this course will enable the students to :

- Understand the concept of automorphism, external direct products.
- Gain the ideas about group actions, stabilizers and kernels, conjugation.

DSE 43 : Mechanics II

This course will enable the students to

- Solve different problems of Newton's laws, equllibrium, language's equation of motion work energy relation.

Also students will offered to take project work instead of Group theory II or Mechanics II.

Mathematics Project work learn the students how to research a topic other than their known topic and how to written this topic. Through this project work the students will be encouraged to pursuing higher studies after completion their graduation.

B.A./B.Sc. (GENERAL) MATHEMATICS

SEMESTER I

CC-1A: Differential Calculus

This course will enable the students to:

- Understand continuity and differentiability in terms of limits.
- Describe asymptotic behaviour in terms of limits involving infinity.
- Use derivatives to explore the behaviour of a given function, locating and classifying its extrema, and graphing the function.
- Understand the importance of Mean Value Theorems.
- Learn about Maclaurin's series expansion of elementary functions

SEMESTER II

CC-1B: Differential Equations

This course will enable the students to:

- Learn basics of differential equations.
- Formulate differential equations for various mathematical models.
- Solve first order linear and non-linear differential equations of higher order using various techniques.

SEMESTER III

CC-1C: Real Analysis

This course will enable the students to:

- Understand the real numbers and their basic properties.
- Be familiar with convergent and Cauchy sequences.
- Test the convergence and divergence of infinite series of real numbers.
- Learn about sequence and series of functions.
- Learn about power series expansion of some elementary functions.

SEC-11: Logic and Sets

This course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction.

SEMESTER IV

CC-1D: Algebra

This course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about the fundamental concept of rings, integral domains and fields.
- Know about ring homomorphisms and isomorphisms theorems of rings.

SEC-21: Vector Calculus

This course will enable the students to:

- Learn to define vector equation of lines and planes.
- Analyze vector functions to find limit, derivatives, tangent lines etc.
- Compute limits and derivatives of functions of two and three variables.
- Determine divergence, curl of vectors.

SEMESTER V

DSE-1A3 : Linear algebra

This course will enable the students to

- Learns about definition of Vector space and its various examples, subspace and dimension of spaces.
- Learn about linear independence and linear dependence.
- Learn about linear transformation, range and kernels of linear transformation, dual, double dual.
- Learn about characteristics polynomial, eigen value, eigen vector of linear transformation.
- Know about isomorphism theorems.

SEC-31: Probability and Statistics

This course will enable the students to:

- Learn about probability density and moment generating functions.
- Know about various univariate distributions such as Bernoulli, Binomial, Poisson, Gamma and Exponential distributions.
- Learn about distributions to study the joint behaviour of two random variables.

SEMESTER VI

DSE-1B3 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.

SEC-42: Transportation and Game Theory

This course will enable the students to:

- Solve the transportation and assignment problems.
- Learn about the solution of rectangular games using graphical method and using the solution of a pair of associated primal-dual linear programming problems.

PROGRAM OUTCOMES

Program: B.A./ B.Sc.; Subject: MATHEMATICS

Session: 2022-- 2023

Mission : The mission of the B.Sc. Hons. in Mathematics under our curriculum is to serve educational needs of our students and, in particular, to offer programs and services that meet the special needs of its diverse student in this metropolitan location. Students are fulfilled with analytic and problem solving skills for their future careers and further higher studies in post graduate or equivalent other professional course. Mathematics is a subject which is a brainchild of Human Beings and possibly must be treated as a most sophisticated subject amongst all science subjects. So our program for mathematics has been build up so beautifully that a newcomer student can acquire a large amount of information regarding Mathematics. Classes develop student abilities and aptitudes to implement mathematical concepts, methods and ideas not only to solve problems in this subject only but also to tackle problems in various fields such as Physics, computer Science, Statistics, Biology, Economics and many other branches of modern science. Students learn to communicate ideas effectively and to digest new information and concepts independently. Mission of this program is to give students the mathematical knowledge and understanding necessary for successful career in business, industry or Government, teaching mathematics in different educational institution and pursuing further higher studies. The department co-operates fully with the UGC, the university of Burdwan and college authorities in every part of their academic planning and incorporate each and every academic decisions which are eventually helps to build up our knowledge based education system in a more concrete way. The Mathematics program of our college in compliance with the syllabus structured by our Burdwan University promotes mathematical skills and knowledge for their intrinsic beauty, effectiveness in developing proficiency in analytical reasoning, and utility in modeling and solving real world problems.

Students who have learnt to logically question assertions, recognize patterns, and distinguish the essential and irrelevant aspects of problems can think deeply and precisely and share their ideas. Students majoring in Mathematics attain proficiency in critical thinking. The ability to identify reflects upon, evaluate, integrate, and apply different types of information and knowledge to form independent judgments. Analytical and logical thinking and the habit of drawing conclusions based on quantitative information.

Goals: The aims of Mathematics department of Hooghly Women's College is to produce academically sound students who will

- successfully compete and take part in various national and international level examinations.
- understand and use mathematics in other field of knowledge with basic mathematical skills for everyday life.
- be well grounded in the basic theoretical excursions in algebra, geometry and beginning level calculus etc.
- develop and understand the importance of proof which distinguishes mathematics from all other disciplines and will demonstrate proficiency in understanding mathematical philosophy and proofs .
- understand the fundamental axioms in mathematics, and capability of developing ideas based on them.

- develop skills to characterize problems, formulate a hypothesis, evaluate and validate outcomes and draw reasonable conclusions thereof.
- develop the effective scientific and technical communications in both oral and written forms.
- gain exposure to a variety of areas of mathematics and related fields such as computer science, the natural sciences, business and economics.
- understand the historical and contemporary role of mathematics and be able to place the discipline properly in the context of other human intellectual achievement.
- be master enough to know how and when to use concepts, ideas and important results.
- acquire knowledge of the variety of mathematical areas and their interrelation.
- acquire the mathematical knowledge and skills necessary for success in their program of career.
- develop the ability to work both independently and collaboratively on mathematical problems.
- acquire knowledge of the roles of intuition, formalization and proof in mathematics.
- develop problem solving skills
- understand and be able to articulate the differences between inductive and deductive reasoning
- formulate conjectures by abstracting general principles from examples.

Problem solving ability:

Students will be able to

- formulate and solve abstract mathematical problems.
- recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems.
- apply mathematical methodologies to open-ended real-world problems.
- recognize connections between different branches of mathematics
- recognize and appreciate the connections between theory and applications.

Effective communication :

Students will be able to

- present mathematics clearly and precisely to an audience of peers and faculty
- appreciate the role of mathematical proof as a means of conveying mathematical knowledge .
- understand the differences between proofs and other less formal arguments .
- make vague ideas precise by formulating them in mathematical language

- describe mathematical ideas from multiple perspectives .
- explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians.

Critical thinking :

Students will

- understand the basic rules of logic, including the role of axioms or assumptions .
- appreciate the role of mathematical proof in formal deductive reasoning .
- be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life .
- understand and be able to articulate the differences between inductive and deductive reasoning .
- proficiently construct logical arguments and rigorous proofs .
- formulate conjectures by abstracting general principles from examples

COURSE OUTCOMES

B.Sc. (HONOURS), Sub: MATHEMATICS

Session: 2022-- 2023

SEMESTER I

CC-01: Calculus, Geometry and Differential Equations

This course will enable the students to:

- Learn about hyperbolic functions, higher order derivatives using Leibnitz Rule and its applications.
- Trace curves in Cartesian and polar coordinates.
- Develop Reduction formulae for different combination of functions.
- Compute arc length and area of surfaces of revolution by integration.
- Sketch conics in a plane using its mathematical properties in the different coordinate systems of reference.

- Learn concepts in two-dimensional and three-dimensional geometry.
- Classification of conics namely, ellipse, parabola and hyperbola and polar equation of conics.
- Learn about three-dimensional objects such as spheres, cylinders, conicoids, generating lines and classification of quadrics.
- Learn about general, particular, singular solutions and integrating factors of ordinary differential equations.
- Solve the exact, linear and Bernoulli equations.

CC-02: Algebra

After the course, the student will be able to:

- Represent complex numbers in polar form and employ De Moivre's theorem in a number of applications.
- Solve problems of inequalities involving A.M., G.M., H.M.
- Learn about equivalence classes and cardinality of a set.
- Apply division algorithm and mathematical induction to problems.
- Solve system of simultaneous linear equations and its applications.
- Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix.
- Find eigen values and corresponding eigenvectors for a square matrix.

SEMESTER II

CC-03: Real Analysis

This course will enable the students to:

- Understand many properties of the real line, including completeness and Archimedean properties.
- Learn to define sequences in terms of functions from the set of natural numbers to a subset of real number.
- Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
- Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence of an infinite series of real numbers.

CC-04: Differential Equation and Vector Calculus

This course will enable the students to:

- Solve linear homogeneous and non-homogeneous differential equations of higher order using various techniques.
- Solve system of linear homogeneous differential equations.
- Develop power series solution of differential equation about ordinary and singular points.

- Understand limits, continuity and derivatives of vector-valued functions and their differentiation and integration.
- Use of vector triple products to problems.
-

SEMESTER III

CC-05: Theory of Real Functions and Introduction to Metric Space

After the course, the student will be able to:

- Have a rigorous understanding of the concept of limit of a function.
- Learn about continuity and uniform continuity of functions defined on intervals.
- Understand continuous functions on closed and bounded intervals.
- Learn extensively about the concept of differentiability using limits, leading to a better understanding for applications.
- Apply Mean Value Theorems and Taylor's theorem to different problems.
- Learn various natural and abstract formulations of distance on the sets of usual or unusual entities. Become aware one such formulations leading to metric spaces.
- Understand various concepts, viz. balls, open set, closed set, limit point, subspace, separable space, etc.

CC-06: Group Theory-I

The course will enable the students to:

- Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups, etc.
- Link the fundamental concepts of groups and symmetrical figures.
- Analyze the subgroups of cyclic groups and classify subgroups of cyclic groups.
- Explain the significance of the notion of cosets, normal subgroups and factor groups.
- Learn about Lagrange's theorem and Fermat's Little theorem.
- Know about group homomorphisms and group isomorphisms.

CC-07: Numerical Methods & Numerical Methods Lab

The course will enable the students to:

- Learn some numerical methods to find the roots of nonlinear equations of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- Solve system of linear equations using Gauss Elimination, Gauss Jordan, Gauss Jacobi, Gauss Seidel and LU Decomposition methods.
- Apply Interpolation techniques to compute the values for a tabulated function at points not in the table.
- Apply numerical differentiation and integration formulae for different problems.

- Solve ordinary differential equations numerically using prominent methods like Euler's, Modified Euler's and Runge-Kutta methods.
- Use C Programming technique for 8 different numerical methods.

SEC11: Logic and Sets

The course will enable the students to:

- Describe memberships of sets, relations between sets.
- Perform operations of union, intersection, complement etc. on sets.
- Recognize when set theory is applicable to real life.
- Explain and apply basic notions of logic.
- Explain validity of natural language augments from the symbolic logical point of view, analyse propositions and propositional logic by natural induction method.

SEMESTER IV

CC-08: Riemann Integration & Series of Functions

After the course, the student will be able to:

- Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental Theorem of Integral Calculus.
- Know about improper integrals including Beta and Gamma functions and their applications.
- Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence.
- Know about the constraints for the interchangeability of differentiability and integrability with infinite sum.
- Apply Fourier Series expansion for different functions.
- Approximate transcendental functions in terms of power series as well as differentiation and integration of power series.

CC-09: Multivariate Calculus

The course will enable the students to:

- Understand and apply the extension of the studies of single variable differential and integral calculus to functions of two or more independent variables. 4
- Use different vector differential operators such as Gradient, Divergence and Curl to problems.
- Know the application of line and surface integrals, Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

CC-10: Ring Theory & Linear Algebra-I

The course will enable the students to:

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- Know about ring homomorphisms and isomorphisms theorems of rings.

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- Know the basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation and the change of coordinate matrix.

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The course will enable the students to:

• Able to define the basic concepts of graphs, directed graphs and weighted graphs.

• Able to define the properties of bipartite graphs, particularly in trees.

• Able to understand Eulerian and Hamiltonian graphs.

SEMESTER V

CC-11: Partial Differential Equations and Applications

After the course, the student will be able to:

- Formulate, classify and transform first order PDEs into canonical form.
- Learn about method of characteristics and separation of variables to solve first order PDE's.
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- Learn about Cauchy problem for second order PDE including homogeneous and nonhomogeneous wave equations.
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After the course, the student will be able to:

- Solve different problems of Statics from Coplanar Forces, Forces in 3D, Virtual Work, Stable and Unstable Equilibrium, Equilibrium of Flexible Strings and Centre of Gravity.
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DSE 11 : Linear Programming

After the course students will be able to

- Solve the problems of L.P.P. Using simplex method, graphical method, two phase method, big-m method.
- Learn about the concepts of convex sets, convex combination, hyperplane.
- Know the concept of duality, Primal dual problems.
- Solve the transportation problems, Game problems, assignment problems.

DSE 21 : Probability and statistics

After the course the students will be able to

- Define probability in different ways
- Know about mathematical expectations, distribution function, random variables.
- Learn about probability density and moment generating function.
- Learn about regression lines, Chebyshev's inequality, law of large numbers, Markov chain.
- Know basic concepts of statistics.
- Solve problems regarding probability and statistics.

SEMESTER VI

CC-13: Metric Spaces and Complex Analysis

The completion of the course will enable the students to:

- Know about Sequences in Metric Spaces, Complete Metric Spaces, Continuity, Homomorphism, Contraction mappings, Banach fixed point theorem and its application to ODE.
- Learn about the two important topological properties, namely connectedness and compactness of metric spaces and related theorems.
- Learn the significance of differentiability of complex functions leading to the understanding of Cauchy−Riemann equations.
- Learn analytic functions, evaluation of the contour integrals and convergence ofsequences and series.
- Understand the role of Cauchy−Goursat theorem and the Cauchy integral formula.
- Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

CC-14: Ring Theory and Linear Algebra-II

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

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B.A./B.Sc. (GENERAL) MATHEMATICS

SEMESTER I

CC-1A: Differential Calculus

This course will enable the students to:

- Understand continuity and differentiability in terms of limits.
- Describe asymptotic behaviour in terms of limits involving infinity.
- Use derivatives to explore the behaviour of a given function, locating and classifying its extrema, and graphing the function.
- Understand the importance of Mean Value Theorems.
- Learn about Maclaurin's series expansion of elementary functions

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CC-1B: Differential Equations

This course will enable the students to:

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- Formulate differential equations for various mathematical models.
- Solve first order linear and non-linear differential equations of higher order using various techniques.

SEMESTER III

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This course will enable the students to:

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- Be familiar with convergent and Cauchy sequences.
- Test the convergence and divergence of infinite series of real numbers.
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SEMESTER V

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This course will enable the students to

- Learns about definition of Vector space and its various examples, subspace and dimension of spaces.
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- Learn about characteristics polynomial, eigen value, eigen vector of linear transformation.
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This course will enable the students to:

- Learn about probability density and moment generating functions.
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- Learn about distributions to study the joint behaviour of two random variables.

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This course will enable the students to:

- Solve the transportation and assignment problems.
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