



Government of West Bengal

Government General Degree College Nakashipara

Department of Mathematics

MURAGACHHA, NADIA, PIN- 741154

Phone No.: 03474-268008 web: www.muragachhagovtcollege.org e-mail: mgcnadia2015@gmail.com

Ref. No.....

Date

TEACHING PLAN FOR THE ACADEMIC SESSION 2024-25 ODD SEMESTER

Semester-I (2024-25 Batch)

(As per syllabus effective from the academic session 2021-22)

| Course Code | Course Title |
|---|--------------------------------|
| B.Sc. Mathematics Hons. | |
| MATH-H-CC-T-01 | Calculus & Analytical Geometry |
| MATH-H-CC-T-02 | Algebra |
| General Elective Course (B.Sc. Hons. other than Mathematics) | |
| MATH-H-GE-T-01 | Algebra & Analytical Geometry |

Teaching Plan

B.Sc. Mathematics (Honours)

SEMESTER-I

Course: MATH-H-CC-T-01

Course title: Calculus & Analytical Geometry

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Hyperbolic functions and its derivative, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b} \sin x, e^{ax+b} \cos x, (ax + b)^n \sin x, (ax + b)^n \cos x$ Pedal equations. Curvature, radius of curvature, centre of curvature, circle of curvature Asymptotes. Singular points, concavity, and inflection points. Curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves. L'Hospital's rule, applications in business, economics, and life sciences. | Mr. Prabir Chakraborty | 25L |
| 2 | <ul style="list-style-type: none"> Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx, \int \cos^n x dx, \int \tan^n x dx, \int \sec^n x dx, \int (\log x)^n dx, \int \sin^n x \cos^m x dx$ Parametric equations, parameterizing a curve, arc length of a | Mr. Prabir Chakraborty | 16L |



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| | curve, arc length of parametric curves, area under a curve, area, and volume of surface of revolution, techniques of sketching conics. | | |
| 3 | <ul style="list-style-type: none"> Transformation of coordinate axes, pair of straight lines, reflection properties of conics, canonical form second degree equations, classification of conics using the discriminant, polar equations of conics. Straight lines in 3D, sphere, cylindrical surfaces. central conicoids, paraboloids, plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid. | Mr. Prabir Chakraborty | 30L |
| Graphical Demonstration (Teaching Aid) | | | |
| | 1. Plotting of graphs of function e^{ax+b} , $\log(ax+b)$, $\frac{1}{ax+b}$, $\sin(ax+b)$, $\cos(ax+b)$, $ ax+b $ and to illustrate the effect of a and b on the graph. 2. Plotting the graphs of polynomials of degree 4 and 5, the derivative graph, the second derivative graph and comparing them. 3. Sketching parametric curves (e.g., trochoid, cycloid, epicycloids, hypocycloid). 4. Obtaining the surface of the revolution of curves. 5. Tracing of conics in Cartesian coordinates/ polar coordinates. 6. Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic, paraboloid, and hyperbolic paraboloid using Cartesian coordinates. | Mr. Prabir Chakraborty | 4L |

B.Sc. Mathematics (Honours)

SEMESTER-I

Course: MATH-H-CC-T-02

Course title: Algebra

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|-------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Polar representation of complex numbers, n-th roots of unity, De Moivre's theorem for rational indices and its applications. Direct and inverse circular form of trigonometric and hyperbolic functions. Exponential & Logarithm of a complex number. Definition of a^z Relation between roots and coefficients, transformation of equation, Descartes rule of signs, solution of cubic equation (Cardan's method). Well-ordering property of positive integers, division algorithm, divisibility, and Euclidean algorithm. Congruence relation between integers. Principles of mathematical induction, statement of | Dr. Biswajit Saha | 30L |



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| | fundamental theorem of arithmetic. | | |
| 2 | <ul style="list-style-type: none"> • Equivalence relations and partitions. Functions, composition of functions, Invertible functions, one to one correspondence and cardinality of a set. • Permutations, cycle notation for permutations, even and odd permutations. • Definition and elementary properties of groups. Symmetries of a square, dihedral groups, quaternion groups (through matrices). Permutation group, alternating group, finite groups: S_3, V_4. The group Z_n of integers under addition modulo n and the group U_n of units under multiplication modulo n. • Order of an element, order of a group, simple properties. | Dr. Biswajit Saha | 25L |
| 3 | <ul style="list-style-type: none"> • Orthogonal matrix and its properties. Rank of a matrix, inverse of a matrix, characterizations of invertible matrices. Row reduced and echelon forms, Normal form, and congruence operations. • Solutions of systems of linear equations of the form $Ax = b$ and their applications. | Dr. Biswajit Saha | 20L |

B.Sc. Other than Mathematics (Honours)

SEMESTER-I

Course: MATH-H-GE-T-01

Course title: Algebra & Analytical Geometry

General Elective Course

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> • Complex numbers De Moivre's theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of a^z. Inverse circular and hyperbolic functions. • Polynomials: Fundamental theorem of algebra (Statement only). Polynomials with real coefficients, nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descartes rule of signs and its applications. Relation between roots and coefficients, transformations of equations. Cardan's method of solution of a cubic equation. • Rank of a matrix: Determination of rank either by considering minors or by sweep-out process. Consistency and solution of a system of linear equations with not more than 3 variables by matrix method. • Equivalence relations and partitions. Functions, composition of functions, invertible functions, one to one correspondence and cardinality of a set • Definition and elementary properties of groups. Concepts of | Mr. Prabir Chakraborty | 40L |



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| | permutation Group, alternating group, finite groups: S_3, V_4 . The group Z_n of integers under addition modulo n . • Order of an element, order of a group, subgroups, and examples of subgroups. | | |
| 2 | <ul style="list-style-type: none"> • Transformations of rectangular axes: Translation, rotation, and their combinations. Invariants. • General equation of second degree in x and y: Reduction to canonical forms. Classification of conics. • Pair of straight lines: Condition that the general equation of 2nd degree in x and y may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by $ax^2 + 2hxy + by^2 = 0$. Equation of bisectors. Equation of two lines joining the origin to the points in which a line meets a conic. • Polar equation of straight lines and circles, polar equation of a conic refers to a focus as a pole, polar equation of chord joining two points, polar equations of tangents and normals. | Mr. Prabir Chakraborty | 35L |



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Semester-III (2022-23 Batch)

(As per syllabus effective from the academic session 2021-22)

| Course Code | Course Title |
|---|--|
| B.Sc. Mathematics Hons. | |
| MATH-H-CC-T-05 | Theory of Real & Vector Functions |
| MATH-H-CC-T-06 | Group Theory I |
| MATH-H-CC-T-07 | Numerical Methods (Theory) & Numerical Methods Lab |
| MATH-H-SEC-T-01 | Programming in 'C' |
| General Elective Course (B.Sc. Hons. other than Mathematics) | |
| MATH-H-GE-T-03 | Algebra & Analytical Geometry |

Teaching Plan

B.Sc. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-CC-T-05

Course title: Theory of Real & Vector Functions

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Limits of functions ($\epsilon - \delta$ approach). Sequential criterion for limits. Divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, neighbourhood property. Sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, Bolzano's Theorem, intermediate value theorem. Location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem. | Dr. Biswajit Saha | 25L |
| 2 | <ul style="list-style-type: none"> Differentiability of a function at a point and in an interval. Caratheodory's theorem. Algebra of differentiable functions. Darboux's theorem. | Dr. Biswajit Saha | 20L |
| 3 | <ul style="list-style-type: none"> Rolle's theorem. Lagrange's and Cauchy's mean value theorems. Taylor's theorem with Lagrange's and Cauchy's forms of remainder. Application of Taylor's theorem to convex functions. Applications of mean value theorem to inequalities and approximation of polynomials. Relative extrema, interior extremum theorem. Taylor's series and Maclaurin's series expansions of exponential | Dr. Biswajit Saha | 20L |



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| | and trigonometric functions, $\log(1+x)$, $\frac{1}{ax+b}$, $(1+x)^n$. • Application of Taylor's theorem to inequalities. | | |
| 4 | • Vector products. • Introduction to vector functions, operations with vector-valued functions. • Limits and continuity of vector functions. • Differentiation and integration of vector functions of one variable $\left(\int_a^b \vec{f}(t) dt\right)$. • Gradient, divergence, curl of vector functions. | Dr. Biswajit Saha | 10L |

B.Sc. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-CC-T-06

Course title: Group Theory-I

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | • Subgroups, examples and properties of subgroups. • Product of two subgroups. • Cyclic group, examples and properties of cyclic group. • Classification of subgroups of cyclic groups. • Cosets and their properties. • Lagrange's theorem and consequences including Fermat's little theorem. | Dr. Biswajit Saha | 30L |
| 2 | • External direct product of a finite number of groups. • Centre of a group, centralizer, normalizer. • Normal subgroups. • Factor groups. • Cauchy's theorem for finite abelian groups. | Dr. Biswajit Saha | 25L |
| 3 | • Group homomorphisms, basic properties of homomorphisms. • Cayley's theorem. • Properties of isomorphisms. • First, second and third isomorphism theorems. | Dr. Biswajit Saha | 20L |



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B.Sc. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-CC-T-07

Course title: Numerical Methods (Theory) & Numerical Methods Lab

Credit-6 (4+2) (Theory + Practical)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

Numerical Methods (Theory)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Algorithms, convergence, errors, relative, absolute, round-off, truncation errors. Interpolation, Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation. Central difference interpolation formula: Stirling and Bessel interpolation Numerical differentiation, methods based on interpolations, methods based on finite differences. | Mr. Prabir Chakraborty | 10L |
| 2 | <ul style="list-style-type: none"> Numerical integration, Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Weddle's rule, Boole's rule. Midpoint rule, composite trapezoidal rule, composite Simpson's 1/3rd rule, Gauss quadrature formula. | Mr. Prabir Chakraborty | 10L |
| 3 | <ul style="list-style-type: none"> Transcendental and polynomial equations, bisection method, Newton's method, secant method, Regula-Falsi method, fixed point iteration, Newton-Raphson method, rate of convergence of these methods. System of linear algebraic equations, Gaussian elimination and Gauss Jordan methods, Gauss Jacobi method, Gauss Seidel method and their convergence analysis, LU decomposition | Mr. Prabir Chakraborty | 10L |
| 4 | <ul style="list-style-type: none"> The algebraic eigenvalue problem, power method. Approximation, least square polynomial approximation. | Mr. Prabir Chakraborty | 10L |
| 5 | <ul style="list-style-type: none"> Ordinary differential equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four. | Mr. Prabir Chakraborty | 10L |

LIST OF PRACTICAL PROBLEMS (Using 'C' or Python programming)

[Two experiments are to be performed in the presence of External Examiner(s) (Marks: 7.5x2) and Viva (Marks: 5)]

(A practical note book must be maintained as a part of Internal Assessment)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|------------------------|-----------------|
| 1 | (i) Calculate the sum of infinite convergent series. (ii) Find the absolute value of an integer. (iii) Enter 100 integers into an array and sort them in an ascending order. (iv) Bisection Method. | Mr. Prabir Chakraborty | 25L |



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|--|---|--|--|
| | (v) Newton Raphson Method. (vi) Secant Method. (vii) Regula-Falsi Method. (viii) LU decomposition Method. (ix) Gauss-Jacobi Method. (x) SOR Method or Gauss-Seidel Method. (xi) Lagrange's Interpolation (xii) Trapezoidal Rule. (xiii) Simpson's rule. | | |
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B.Sc. Mathematics (Honours)

SEMESTER-III

Course: MATH-H-SEC-T-1A

Course title: Programming in 'C'

Skill Enhancement Course

Credit-2 (Theory)

Full Marks-50 (Internal Assessment: 10 marks; Semester-end Exam: 40 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Brief historical development. Computer generation. Basic structure and elementary ideas of computer systems, operating systems, hardware and software. Positional number systems: Binary, octal, decimal, hexadecimal systems. Binary arithmetic. BIT, BYTE, WORD. Coding of data -ASCII, EBCDIC, etc. Algorithms and flow chart: Important features, ideas about complexities of algorithms. Application in simple problems. | Mr. Prabir Chakraborty | 7L |
| 2 | <ul style="list-style-type: none"> Programming language and importance of 'C' programming. Constants, variables and data type of 'C'-Program: Character set. Constants and variables data types, expression, assignment statements, declaration. Operation and expressions: Arithmetic operators, relational operators, logical operators. Decision making and branching: Decision making with if statement, if-else statement, nesting if statement, switch statement, break and continue statement. Control statements: While statement, do-while statement, for statement. Arrays: One-dimension, two-dimensional and multidimensional arrays, declaration of arrays, initialization of one and multi-dimensional arrays. User-defined Functions: Definition of functions, scope of variables, return values and their types, function declaration, function call by value, nesting of functions, passing of arrays to functions, recurrence of function. | Mr. Prabir Chakraborty | 18L |



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B.Sc. Other than Mathematics (Honours)

SEMESTER-III

Course: MATH-H-GE-T-03

Course title: Algebra & Analytical Geometry

General Elective Course

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Complex numbers De Moivre's theorem and its applications. Exponential, Sine, Cosine and Logarithm of a complex number. Definition of a^z. Inverse circular and hyperbolic functions. Polynomials: Fundamental theorem of algebra (Statement only). Polynomials with real coefficients, nature of roots of an equation (surd or complex roots occur in pairs). Statement of Descartes rule of signs and its applications. Relation between roots and coefficients, transformations of equations. Cardan's method of solution of a cubic equation. Rank of a matrix: Determination of rank either by considering minors or by sweep-out process. Consistency and solution of a system of linear equations with not more than 3 variables by matrix method. Equivalence relations and partitions. Functions, composition of functions, invertible functions, one to one correspondence and cardinality of a set Definition and elementary properties of groups. Concepts of permutation Group, alternating group, finite groups: S_3, V_4. The group Z_n of integers under addition modulo n. Order of an element, order of a group, subgroups, and examples of subgroups. | Mr. Prabir Chakraborty | 40L |
| 2 | <ul style="list-style-type: none"> Transformations of rectangular axes: Translation, rotation, and their combinations. Invariants. General equation of second degree in x and y: Reduction to canonical forms. Classification of conics. Pair of straight lines: Condition that the general equation of 2nd degree in x and y may represent two straight lines. Point of intersection of two intersecting straight lines. Angle between two lines given by $ax^2 + 2hxy + by^2 = 0$. Equation of bisectors. Equation of two lines joining the origin to the points in which a line meets a conic. Polar equation of straight lines and circles, polar equation of a conic refers to a focus as a pole, polar equation of chord joining two points, polar equations of tangents and normals. | Mr. Prabir Chakraborty | 35L |



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Semester-V (2022-23 Batch)

(As per syllabus effective from the academic session 2018-19)

| Course Code | Course Title |
|---------------------------------|---|
| B.Sc. Mathematics Hons. | |
| MATH-H-CC-T-11 | Partial Differential Equations and Applications |
| MATH-H-CC-T-12 | Group Theory-II |
| MATH-H-DSE-T-01 | Linear Programming |
| MATH-H-DSE-T-02 | Probability & Statistics |
| B.Sc. Programme/ General | |
| MATH-G-DSE-T-01 | Complex Analysis |
| MATH-G-SEC-T-03 | Theory of Equations |

Teaching Plan

B.Sc. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-CC-T-11

Course title: Partial Differential Equations & Applications

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | Partial differential equations – Basic concepts and definitions. Mathematical problems. First- order equations: classification, construction and geometrical interpretation. Method of characteristics for obtaining general solution of quasi linear equations. Canonical forms of first-order linear equations. Method of separation of variables for solving first order partial differential equations. | Mr. Prabir Chakraborty | 20L |
| 2 | Derivation of heat equation, wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic or elliptic. Reduction of second order linear equations to canonical forms. | Mr. Prabir Chakraborty | 20L |
| 3 | The Cauchy problem, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string. Initial boundary value problems. Semi-infinite string with a fixed end, semi-infinite string with a free end. Equations with non-homogeneous boundary conditions. Non- homogeneous wave equation. Method of separation of variables, solving the vibrating string problem. | Mr. Prabir Chakraborty | 30L |



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| Solving the heat conduction problem. | | | |
| Graphical Demonstration (Teaching aid) | | | |
| <ol style="list-style-type: none"> 1. Solution of Cauchy problem for first order PDE. 2. Finding the characteristics for the first order PDE. 3. Plot the integral surfaces of a given first order PDE with initial data. 4. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions: <ol style="list-style-type: none"> (a) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), x \in R, t > 0.$ (b) $u(x,0) = \phi(x), u_t(x,0) = \psi(x), u(0,t) = 0, x \in (0, \infty), t > 0$ 5. Solution of wave equation $\frac{\partial^2 u}{\partial t^2} - c^2 \frac{\partial^2 u}{\partial x^2} = 0$ for the following associated conditions: <ol style="list-style-type: none"> (a) $u(x,0) = \phi(x), u(0,t) = a, u(l,t) = b, 0 < x < l, t > 0.$ <p>$u(x,0) = \phi(x), x \in R, 0 < t < T.$</p> | | Mr. Prabir Chakraborty | 5L |

B.Sc. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-CC-T-12

Course title: Group Theory II

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties. | Dr. Biswajit Saha | 25L |
| 2 | Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental theorem of finite abelian groups. | Dr. Biswajit Saha | 20L |
| 3 | Groups acting on themselves by conjugation, class equation and consequences, conjugacy in S_n , p-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of A_n for $n \geq 5$, non-simplicity tests. | Dr. Biswajit Saha | 30L |



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B.Sc. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-DSE-T-1A

Course title: Linear Programming

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|------------------------|-----------------|
| 1 | Introduction to linear programming problem. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison. | Mr. Prabir Chakraborty | 30L |
| 2 | Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual. Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem. | Mr. Prabir Chakraborty | 25L |
| 3 | Game theory: formulation of two persons zero sum games, solving two-person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games. | Mr. Prabir Chakraborty | 20L |

B.Sc. Mathematics (Honours)

SEMESTER-V

Course: MATH-H-DSE-T-2A

Course title: Probability and Statistics

Department Specific Elective Course

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|------------------------|-----------------|
| 1 | Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential. | Mr. Prabir Chakraborty | 25L |



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| 2 | Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient. | Mr. Prabir Chakraborty | 20L |
| 3 | Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers. Central limit theorem for independent and identically distributed random variables with finite variance. | Mr. Prabir Chakraborty | 20L |
| 4 | Random Samples, Sampling Distributions, Estimation of parameters, Testing of hypothesis. | Mr. Prabir Chakraborty | 10L |

B.Sc. Mathematics (GENERAL)

SEMESTER-V

Course: MATH-G-DSE-T-1B

Course title: Complex Analysis

Discipline specific Elective Course

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy- Riemann equations, sufficient conditions for differentiability. | Dr. Biswajit Saha | 20L |
| 2 | Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions. | Dr. Biswajit Saha | 20L |
| 3 | Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula. | Dr. Biswajit Saha | 20L |
| 4 | Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples. | Dr. Biswajit Saha | 10L |
| 5 | Laurent series and its examples, absolute and uniform convergence of power series. | Dr. Biswajit Saha | 5L |

B. Sc. Mathematics (GENERAL)

SEMESTER-V

Course: MATH-G-SEC-T-3A

Course title: Integral Calculus

Skill Enhancement course



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Date

Credit-2 (Theory)

Full Marks-50 (Internal Assessment: 10 marks; Semester-end Exam: 40 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|-------------------|-----------------|
| 1 | Integration by Partial fractions, integration of rational and irrational functions. Properties of definite integrals. Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic functions and of their combinations. | Dr. Biswajit Saha | 25L |
| 2 | Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution. Double and Triple integrals. | Dr. Biswajit Saha | 25L |



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Date

TEACHING PLAN FOR THE ACADEMIC SESSION 2024-25 EVEN SEMESTER

Semester-II

(As per syllabus effective from the academic session 2021-22)

| Course Code | Course Title |
|---|-----------------------------------|
| B.Sc. Mathematics Hons. | |
| MATH-H-CC-T-03 | Real Analysis |
| MATH-H-CC-T-04 | Differential Equations |
| General Elective Course (B.Sc. Hons. other than Mathematics) | |
| MATH-H-GE-T-02 | Calculus & Differential Equations |

Teaching Plan

B.Sc. Mathematics (Honours)

SEMESTER-II

Course: MATH-H-CC-T-03

Course title: Real Analysis

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|-------------------|-----------------|
| 1 | <ul style="list-style-type: none"> The natural numbers Peano's axioms. Review of algebraic and order properties of \mathbb{R}. Bounded above sets, bounded below sets, bounded sets, unbounded sets. L.U.B. (supremum) and G.L.B. (infimum) of a set and its properties. L.U.B. axiom or order completeness of \mathbb{R}. Idea of countable sets, uncountable sets and uncountability of \mathbb{R}. Countability of \mathbb{Q}. The Archimedean property, density of rational (and irrational) numbers in \mathbb{R}. | Dr. Biswajit Saha | 17L |
| 2 | <ul style="list-style-type: none"> Intervals, ϵ-neighbourhood of a point in \mathbb{R}, interior points and open sets, limit points and closed sets, union and intersection of open and closed sets, isolated points, adherent point, derived set, closure of a set, interior of a set. Illustrations of Bolzano-Weierstrass theorem for sets. Upper and lower limits of a subset of \mathbb{R} Compact set in \mathbb{R} basic properties of compact sets. Lindelöf covering theorem (statement only). Heine-Borel theorem and its application. Converse of Heine-Borel theorem. | Dr. Biswajit Saha | 18L |
| 3 | <ul style="list-style-type: none"> Sequences, bounded sequence, convergent sequence, limit of a | Dr. Biswajit | 20L |



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| | | | |
|---|---|-------------------|-----|
| | sequence, $\liminf x_n$, $\limsup x_n$. <ul style="list-style-type: none"> • Limit theorems. Sandwich theorem. Nested interval theorem. • Monotone sequences, monotone convergence theorem. • Subsequences, divergence criteria. Monotone subsequence theorem (statement only). • Bolzano Weierstrass theorem for sequences. • Cauchy sequence, Cauchy's convergence criterion, Cauchy's 1st and 2nd limit theorems. | Saha | |
| 4 | <ul style="list-style-type: none"> • Infinite series, convergence and divergence of infinite series, Cauchy criterion. • Tests for convergence: comparison test, limit comparison test, ratio test: D'Alembert's ratio test, Raabe's test, Cauchy's root test, Gauss test (Statement only), integral test, Cauchy's condensation test with examples. • Alternating series, Leibnitz test. Absolute and conditional convergence. | Dr. Biswajit Saha | 15L |
| Graphical Demonstration (Teaching Aid) | | | |
| | <ol style="list-style-type: none"> 1. Plotting of recursive sequences. 2. Study the convergence of sequences through plotting. 3. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot. 4. Study the convergence/divergence of infinite series by plotting their sequences of partial sum. 5. Cauchy's root test by plotting nth roots. 6. Ratio test by plotting the ratio of nth and (n+1)th term. | Dr. Biswajit Saha | 4L |

B.Sc. Mathematics (Honours)

SEMESTER-II

Course: MATH-H-CC-T-04

Course title: Differential Equations

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> • Differential equations and mathematical models. • General, particular, explicit, implicit and singular solutions of a differential equation. • Separable equations and equations reducible to this form. • Exact differential equations and integrating factors. • Linear equation and Bernoulli equations, special integrating factors and transformations. • First order and higher degree differential equations, solvable for x, y and p, Clairaut's Equations general and singular solutions. | Mr. Prabir Chakraborty | 15L |
| 2 | <ul style="list-style-type: none"> • Lipschitz condition and Picard's Theorem (Statement only). • General solution of homogeneous equation of second order, principle of superposition for homogeneous equation. • Wronskian: its properties and applications, linear homogeneous and non-homogeneous equations of higher order with constant coefficients. | Mr. Prabir Chakraborty | 15L |



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| | <ul style="list-style-type: none"> Euler's equation, method of undetermined coefficients. Method of variation of parameters. | | |
| 3 | <ul style="list-style-type: none"> Systems of linear differential equations. Types of linear systems. Differential operators. An operator method for linear systems with constant coefficients. Basic Theory of linear systems in normal form. Homogeneous linear systems with constant coefficients, two Equations in two unknown functions. | Mr. Prabir Chakraborty | 15L |
| 4 | <ul style="list-style-type: none"> Equilibrium points. Interpretation of the phase plane. Power series solution of a differential equation about an ordinary point, solution about a regular singular point. | Mr. Prabir Chakraborty | 10L |
| 5 | <ul style="list-style-type: none"> Partial differential equations – Basic concepts and definitions. Mathematical problems. First- order equations: classification, construction and geometrical interpretation, Lagrange's method, Charpit's method. Method of characteristics for obtaining general solution of quasi-linear equations. Canonical forms of first-order linear equations. Method of separation of variables for solving first order partial differential equations. | Mr. Prabir Chakraborty | 15L |
| Graphical Demonstration (Teaching Aid) | | | |
| 1. Plotting a family of curves which are solutions of second order differential equations. 2. Plotting a family of curves which are solutions of third order differential equations. | | Mr. Prabir Chakraborty | 5L |

B.Sc. Other than Mathematics (Honours)

SEMESTER-II

Course: MATH-H-GE-T-02

Course title: Calculus & Differential Equations

General Elective Course

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Real-valued functions defined on an interval, limit and Continuity of a function (using $\epsilon - \delta$). Algebra of limits. Differentiability of a function. Successive derivative Leibnitz's theorem and its application to problems of type $e^{ax+b} \sin x, e^{ax+b} \cos x, (ax+b)^n \sin x, (ax+b)^n \cos x$ Partial derivatives. Euler's theorem on homogeneous function of two and three variables. Indeterminate Forms L'Hospital's Rule (Statement and Problems only). Statement of Rolle's Theorem and its geometrical interpretation. | Mr. Prabir Chakraborty | 35L |



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| | Mean value theorems of Lagrange and Cauchy. Statements of Taylor's and Maclaurin's theorems with Lagrange's and Cauchy's forms of remainders. Taylor's and Maclaurin's infinite series of functions like e^x , $\sin x$, $\cos x$, $(1+x)^n$, $\log(1+x)$ with restrictions wherever necessary. ● Application of the principle of maxima and minima for a function of a single variable. | | |
| 2 | ●Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int \sec^n x dx$, $\int (\log x)^n dx$, $\int \sin^n x \cos^m x dx$ | Mr. Prabir Chakraborty | 15L |
| 3 | ● First order equations: (i) Exact equations and those reducible to such equations. (ii) Euler's and Bernoulli's equations (Linear). (iii) Clairaut's Equations General and Singular solutions. ● Second order differential equation: (i) Method of variation of parameters, (ii) Method of undetermined coefficients. | Mr. Prabir Chakraborty | 25L |



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Semester-IV (2023-24 Batch)

(As per syllabus effective from the academic session 2021-22)

| Course Code | Course Title |
|---|---|
| B.Sc. Mathematics Hons. | |
| MATH-H-CC-T-08 | Ring Theory and Linear Algebra |
| MATH-H-CC-T-09 | Multivariate Calculus & Tensor Analysis |
| MATH-H-CC-T-10 | Linear Programming Problems & Game Theory |
| MATH-H-SEC-T-02 | Graph Theory |
| General Elective Course (B.Sc. Hons. other than Mathematics) | |
| MATH-H-GE-T-04 | Calculus & Differential Equation |

Teaching Plan

B.Sc. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-CC-T-08

Course title: Riemann Integration and Series of Functions

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Definition and examples of rings. Properties of rings. Subrings. Integral domains and fields. Characteristics of a ring. Ideal, ideal generated by a subset of a ring. Factor rings. Operations on ideals. Prime and maximal ideals. | Dr. Biswajit Saha | 20L |
| 2 | <ul style="list-style-type: none"> Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III. Field of quotients. | Dr. Biswajit Saha | 20L |
| 3 | <ul style="list-style-type: none"> Concept of Vector space over a field: Examples, concepts of Linear combinations, linear dependence and independence of a finite number of vectors. Sub- space, concepts of generators and basis of a finite dimensional vector space. Replacement theorem. Extension theorem. Deletion theorem and their applications. Row space, column space. Euclidean Spaces. Orthogonal and orthonormal vectors. Gram-Schmidt process of orthogonalization. | Dr. Biswajit Saha | 20L |
| 4 | <ul style="list-style-type: none"> Linear transformations. Null space. Range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Eigenvalues, eigen vectors and characteristic equation of a matrix. Matric polynomials, Cayley-Hamilton theorem and its use in finding the | Dr. Biswajit Saha | 15L |



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| | inverse of a matrix. • Diagonalization, Canonical forms. | | |
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B.Sc. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-CC-T-09

Course title: Multivariate Calculus& Tensor Analysis

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | <ul style="list-style-type: none"> • Functions of several variables, limit and continuity of functions of two or more variables. • Differentiability and total differentiability. Partial differentiation. • Sufficient condition for differentiability. Schwarz Theorems, Young's Theorems. • Chain rule for one and two independent parameters. • Homogeneous function and Euler's theorem on homogeneous functions and its converse. • Jacobians and functional dependence. • Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems. | Dr. Biswajit Saha | 20L |
| 2 | <ul style="list-style-type: none"> • Double integration over a rectangular region. Double integration over non-rectangular regions. Double integrals in polar coordinates. • Triple integrals. Triple integral over parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical coordinates. • Change of variables in double integrals and triple integrals. | Dr. Biswajit Saha | 15L |
| 3 | <ul style="list-style-type: none"> • Directional derivatives. The gradient, maximal and normal property of the gradient. • Line integrals, applications of line integrals: Mass and work. Fundamental theorem for line integrals, conservative vector fields, independence of path. • Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The divergence theorem. Applications of Green's, Stoke's and divergence theorems. | Dr. Biswajit Saha | 15L |
| 4 | <ul style="list-style-type: none"> • A tensor as a generalized concept of a vector in E^2 and its generalization in E^n. Space of n-dimension. Transformation of coordinates. Summation convention. • Definition of scalar or invariant. Contravariant, covariant vectors and tensors, mixed tensors of arbitrary order. Kronecker delta. • Equality of tensors, addition, subtraction of two tensors. • Outer product of tensors, contraction and inner product of tensors. • Symmetric and skew symmetric tensors. • Quotient law, reciprocal tensor of a tensor. • Metric tensor, Christoffel symbol, covariant derivative. | Dr. Biswajit Saha | 25L |



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B.Sc. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-CC-T-10

Course title: Linear Programming Problems & Game Theory

Credit-6(4+2) (Theory + Practical)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Introduction to linear programming problems. Mathematical formulation of LPP. Graphical solution. Convex sets. Basic solutions (B.S.) and non-basic solutions. Reduction of B.F.S from B.S. | Mr. Prabir Chakraborty | 10L |
| 2 | <ul style="list-style-type: none"> Theory of simplex method. Optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison. Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual. | Mr. Prabir Chakraborty | 20L |
| 3 | <ul style="list-style-type: none"> Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of initial basic solution. Algorithms for solving transportation problems. Assignment problem and its mathematical formulation, Hungarian method for solving assignment problems. Travelling Salesman Problems. | Mr. Prabir Chakraborty | 25L |
| 4 | <ul style="list-style-type: none"> Game theory: Formulation of two-person zero sum games. Solving two persons zero sum games. Games with mixed strategies. Graphical solution procedure. Solving game using simplex algorithm. | Mr. Prabir Chakraborty | 20L |

B.Sc. Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-SEC-T-2B

Course title: Graph Theory

Skill Enhancement Course

Credit-2(Theory)

Full Marks-50 (Internal Assessment: 10 marks; Semester-end Exam: 40 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bi-partite graphs isomorphism of graphs. | Mr. Prabir Chakraborty | 8L |
| 2 | <ul style="list-style-type: none"> Eulerian circuits, Eulerian graphs, semi-Eulerian graphs, Hamiltonian cycles. Representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph. | Mr. Prabir Chakraborty | 10L |
| 3 | <ul style="list-style-type: none"> Travelling salesman's problem, shortest path, tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm. | Mr. Prabir Chakraborty | 7L |



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B.Sc. Other than Mathematics (Honours)

SEMESTER-IV

Course: MATH-H-GE-T-04

Course title: Calculus & Differential Equation

General Elective Course

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | <ul style="list-style-type: none"> Real-valued functions defined on an interval, limit and Continuity of a function (using $\epsilon - \delta$). Algebra of limits. Differentiability of a function. Successive derivative Leibnitz's theorem and its application to problems of type $e^{ax+b} \sin x, e^{ax+b} \cos x, (ax+b)^n \sin x, (ax+b)^n \cos x$ Partial derivatives. Euler's theorem on homogeneous function of two and three variables. Indeterminate Forms L'Hospital's Rule (Statement and Problems only). Statement of Rolle's Theorem and its geometrical interpretation. Mean value theorems of Lagrange and Cauchy. Statements of Taylor's and Maclaurin's theorems with Lagrange's and Cauchy's forms of remainders. Taylor's and Maclaurin's infinite series of functions like $e^x, \sin x, \cos x, (1+x)^n, \log(1+x)$ with restrictions wherever necessary. Application of the principle of maxima and minima for a function of a single variable. | Dr. Biswajit Saha | 35L |
| 2 | <ul style="list-style-type: none"> Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin^n x dx, \int \cos^n x dx, \int \tan^n x dx, \int \sec^n x dx, \int (\log x)^n dx, \int \sin^n x \cos^m x dx$ | Dr. Biswajit Saha | 15L |
| 3 | <ul style="list-style-type: none"> First order equations: (i) Exact equations and those reducible to such equations. (ii) Euler's and Bernoulli's equations (Linear). (iii) Clairaut's Equations General and Singular solutions. Second order differential equation: (i) Method of variation of parameters, (ii) Method of undetermined coefficients. | Dr. Biswajit Saha | 25L |



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Semester-VI (2022-23 Batch)

(As per syllabus effective from the academic session 2018-19)

| Course Code | Course Title |
|---------------------------------|------------------------------------|
| B.Sc. Mathematics Hons. | |
| MATH-H-CC-T-13 | Metric Spaces and Complex Analysis |
| MATH-H-CC-T-14 | Ring Theory and Linear Algebra II |
| MATH-H-DSE-T-03 | Number Theory |
| MATH-H-DSE-T-04 | Mechanics |
| B.Sc. Programme/ General | |
| MATH-G-DSE-T-02 | Linear Programming |
| MATH-G-SEC-T-04 | Probability and Statistics |

Teaching Plan

B.Sc. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-CC-T-13

Course title: Metric Spaces and Complex Analysis

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|-------------------|-----------------|
| 1 | Metric spaces: sequences in metric spaces, Cauchy sequences. Complete metric spaces, Cantor's theorem. | Dr. Biswajit Saha | 15L |
| 2 | Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Compactness and connectedness in metric spaces. Compactness: Sequential compactness, Heine-Borel property, totally bounded spaces, finite intersection property, and continuous functions on compact sets. Homeomorphism.. | Dr. Biswajit Saha | 20L |
| 3 | Limits, limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability. | Dr. Biswajit Saha | 20L |
| 4 | Analytic functions, examples of analytic functions, exponential function, logarithmic function, trigonometric function, derivatives of functions, and definite integrals of functions. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula. | Dr. Biswajit Saha | 20L |



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B.Sc. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-CC-T-14

Course title: Ring Theory and Linear Algebra II

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III, field of quotients. Polynomial rings over commutative rings, division algorithm and consequences, principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion, and unique factorization in $\mathbb{Z}[x]$. | Dr. Biswajit Saha | 25L |
| 2 | Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators. Eigen spaces of a linear operator. | Dr. Biswajit Saha | 20L |
| 3 | Diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator, canonical forms, Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements. | Dr. Biswajit Saha | 30L |

B.Sc. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-DSE-T-3B

Course title: Number Theory

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|-------------------|-----------------|
| 1 | Linear diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linear congruences, complete set of residues. Chinese remainder theorem, Fermat's little theorem, Wilson's theorem. | Dr. Biswajit Saha | 30L |
| 2 | Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the Mobius Inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function. | Dr. Biswajit Saha | 25L |
| 3 | Order of an integer modulo n , primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the equation $x^2 + y^2 = z^2$, Fermat's Last theorem. (statement) | Dr. Biswajit Saha | 20L |



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B.Sc. Mathematics (Honours)

SEMESTER-VI

Course: MATH-H-DSE-T-4A

Course title: Mechanics

Department Specific Elective Course

Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|---|------------------------|-----------------|
| 1 | Co-planar forces. Astatic equilibrium. Friction. Equilibrium of a particle on a rough curve. Virtual work.. Forces in three dimensions. General conditions of equilibrium. Centre of gravity for different bodies. Stable and unstable equilibrium. | Mr. Prabir Chakraborty | 25L |
| 2 | Central force. Constrained motion, varying mass, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law. | Mr. Prabir Chakraborty | 10L |
| 3 | Equations of motion referred to a set of rotating axes. Motion of a projectile in a resisting medium. Stability of nearly circular orbits. Motion under the inverse square law.Slightly disturbed orbits. Motion of artificial satellites. Motion of a particle in three dimensions. Motion on a smooth sphere, cone, and on any surface of revolution. | Mr. Prabir Chakraborty | 20L |
| 4 | Degrees of freedom. Moments and products of inertia. Momental Ellipsoid. Principal axes. D'Alembert's Principle. Motion about a fixed axis. Compound pendulum. Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of momentum and energy. | Mr. Prabir Chakraborty | 20L |



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B.Sc. Mathematics (GENERAL)

SEMESTER-VI

Course: MATH-G-DSE-T-2A

Course title: Linear Programming

Discipline specific Elective Course; Credit-6(5+1) (Theory + Tutorial)

Full Marks-75 (Internal Assessment: 15 marks; Semester-end Exam: 60 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|------------------------|-----------------|
| 1 | Introduction to linear programming problems. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness, the simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison. | Mr. Prabir Chakraborty | 20L |
| 2 | Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual. | Mr. Prabir Chakraborty | 20L |
| 3 | Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem. | Mr. Prabir Chakraborty | 20L |
| 4 | Game theory: formulation of two-person zero sum games, solving two-person zero sum games, games with mixed strategies, graphical solution procedure, linear programming solution of games. | Mr. Prabir Chakraborty | 10L |

B.Sc. Mathematics (GENERAL)

SEMESTER-VI

Course: MATH-G-SEC-T-4A

Course title: Probability and Statistics

Skill Enhancement course

Credit-2 (Theory)

Full Marks-50 (Internal Assessment: 10 marks; Semester-end Exam: 40 marks)

| Unit | Topic | Teacher | No. of Lectures |
|------|--|-------------------|-----------------|
| 1 | Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, continuous distributions: uniform, normal, exponential. | Dr. Biswajit Saha | 25L |
| 2 | Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables. | Dr. Biswajit Saha | 25L |