BALAGARH BIJOY KRISHNA MAHAVIDYALAYA

Department of Mathematics

Syllabus and Course Module for odd semester 2022-23

1st. SEMESTER (HONOURS)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO OF CLASSES	Curriculum Delivery
BMH1CC01	Calculus, Geometry & Differential Equations	Unit -1: Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type sin ax b e x + , cos ax b e x + , (ax+b)n sinx, (ax+b)n cosx, concavity and inflection points, envelopes, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences Unit-2 : Reduction formulae, derivations and illustrations of reduction formulae for the integration of sin nx, cosnx, tan nx, sec nx, (log x)n , sinn xsinmx, parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution. Techniques of sketching conics. Unit -3: Reflection properties of conics, translation and rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics. Spheres.Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, Generating lines, classification of quadrics, Illustrations of	**Sanjukta Das**	**60**	**Lecture** **Tutorial** **Assignment: 01** Class test- 01 PPT-01

		graphing standard quadric surfaces like cone, ellipsoid. Unit – 4: Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation.Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.			

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH1CC02	Algebra	Unit -1 :Polar representation of complex numbers, n-th roots of unity, De Moivre's theorem for rational indices and its applications. Theory of equations: Relation between roots and coefficients,Transformation of equation,Descartes rule of signs, Cubic and biquadratic equations, reciprocal equation,separation of the roots of equations,Strum's theoremInequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequalityUnit -2 :Equivalence relations and partitions, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set. Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm.Congruence relation between integers.Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.1Unit -3:Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, linear independence. Unit 4:Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Vector spaces, Subspaces of Rn , dimension of subspaces of Rn , rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix	**Papia Ghosh**	**60**	**Lecture, Tutorial, Class Test-01 PPT-02 Remedial Class-02**

1st. SEMESTER (GENERAL)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMG1CC1A	**Differential Calculus**	1.LIMIT .CONTINUITY,SUCCESSIVE DIFFERENTIATION ,LEIBNITZ'S THEOREM,PARTIAL DIFFERENTIAL EQUATION,EULER'S THEOREM ON HOMOGENOUS FUNCTIONS 2.TANGENT, NORMAL, CURVATURE,ASYMPTOTES,S INGULAR POINTS TRACING OF CURVES AND PARAMETRISENTATION OF CURVES POLAR COORDINATES 3.ROLLE'S THEOREM,MEAN VALUE YHEOREM,TAYLOR'S THEOREM,TAYLORS SERIES, MACLAURIN'S SERIES	**Dr. Biswajit Paul**	**60**	**Lecture, Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

3rd SEMESTER (HONOURS)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH3CC05	Theory of Real Functions & Introduction to Metric Space	Unit -1:Limits of functions (ε - δ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, theorems on uniform continuity. Unit -2 :Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum, Rolle's theorem. Mean value theorem, intermediate value property of derivatives, Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Application of differential calculus : Curvature Unit-3:Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, ln(1 + x), 1/ax+b and (1 +x)n . Application of Taylor's theorem to inequalities. Unit-4 :Metric spaces: Definition and examples. Open and closed balls, neighbourhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, subspaces, dense sets, separable spaces	**Papia Ghosh**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-02** **Remedial Class-02**

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH3CC06	Group Theory–I	Unit-1 :Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (through matrices), elementary properties of groups.. Unit-2:Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups Unit-3 :Properties of cyclic groups, classification of subgroups of cyclic groups, Cycle notation for permutations, properties of permutations, even and odd permutations, alternating group, properties of cosets, Lagrange's theorem and consequences including Fermat's Little theoremUnit-4: External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups. Unit-5: Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems	**Sanjukta Das**	**60**	**Lecture, Tutorial, Class Test-01 PPT-01 Remedial Class-01**

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH3CC07	Numerical Methods & Numerical Methods Lab	Unit-1: Algorithms, Convergence, Errors: Relative, Absolute. Round off, Truncation. Unit-2 : Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method, Regulafalsi method, fixed point iteration, Newton-Raphson method. Rate of convergence of these methods. Unit -3 : System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis, LU Decomposition. Unit-4: Interpolation: Lagrange and Newton's methods, Error bounds, Finite difference operators. Gregory forward and backward difference interpolations. Numerical differentiation: Methods based on interpolations, methods based on finite differences. Unit – 5 : Numerical Integration: Newton Cotes formula, Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Weddle's rule, Boole's rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's 1/3rd rule, Gauss quadrature formula. The algebraic eigenvalue problem: Power method. Unit – 6: Ordinary Differential Equations: The method of successive approximations, Euler's method, the modified Euler method, Runge-Kutta methods of orders two and four.	**Dr. Biswajit Paul**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH3SEC11	Logic and Sets	Unit 1 : Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations Unit 2 : Sets, subsets, Set operations and the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set. Unit 3 : Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set. Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation. Partial ordering relations, n- ary relations.	**Dr. Biswajit Paul**	**40**	**Lecture,** **Tutorial, Class Test-01** **PPT-01** **Remedial Class-01**

3rd SEMESTER (GENERAL)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMG4CC1C	**Algebra**	FINITE AND INFINITE SETS,COUNTABLE AND UNCOUNTABLE SETS,REAL LINE,BOUNDED SETS, SUPREMA INFIMA,COMPLETENESS PROPERTY,ARCHIMEDEAN PROPERTY,INTERVALS,CLUSTER POINTS, BOLZANO WEIERSTRASS THEOREM REAL SEQUENCE, BOUNDED SEQUENCE,CAUCHY CONVERGENCE CRITERION FOR SEQUENCE, CAUCHY'S THEOREM ON LIMITS, MONOTONE SEQUENCE INFINITE SERIES,CAUCHY CONVERGENCE CRITERION FOR SERIES,GEOMETRIC SERIES,COMPARISON TEST,ROOT TEST,RATIO TEST,ALTERNATING TEST, LEIBNITZ'S TEST,ABSOLUTE AND CONDITIONAL CONVERGENCE SEQUENCE AND SERIES OF FUNCTIONS,POINTWISE AND UNIFORM CONVERGENCE,Mn TEST,M TEST,POWER SERIES RADIUS OF CONVERGENCE	**Dr. Biswajit Paul**	60	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial** **Class-01**

5th SEMESTER (HONOURS)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH5CC11	Partial Differential Equations and Applications	Unit 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. Unit 2: Derivation of Heat equation, Wave equation and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic, elliptic. Reduction of second order Linear Equations to canonical forms. Unit 3: The Cauchy problem of 2nd order partial differential equation, Cauchy-Kowalewskaya theorem, Cauchy problem of an infinite string, Initial and Boundary Value Problems. Semi-Infinite String with a fixed end, SemiInfinite 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. Solving the Heat Conduction problem	**Papia Ghosh**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH5CC12	Mechanics I	Unit 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, equilibrium of flexible string Unit 2 : Simple harmonic motion, Damped and forced vibrations, Components of velocity and acceleration, Equations of motion referred to a set of rotating axes. Motion of a projectile in a resisting medium. Motion of a particle under central force, Keplar's laws of motion, Motion under the inverse square law, Stability of nearly circular orbits, Slightly disturbed orbits, Motion of artificial satellites. Varying mass, constrained, Motion of a particle in three dimensions. Motion on a smooth sphere, cone, and on any surface of revolution Unit 3 : 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 system of particles, Motion of a rigid body in two dimensions under finite and impulsive forces, Conservation of momentum and energy	**Dr. Biswajit Paul**	**60**	**Lecture,** **Tutorial, Class Test-01** **PPT-01** **Remedial Class-01**

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH5DSE11	Linear Programming	Unit 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 Unit 2 : Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual, Dual Simplex method. Unit 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, Travelling salesman problem Unit 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.	**Dr. Biswajit Paul**	**60**	**Lecture, Tutorial, Class Test-01 PPT-01 Remedial Class-01**
BMH5DSE21	Probability and Statistics	Unit 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 Unit 2 : Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation	Sanjukta Das	60	**Lecture, Tutorial, Class Test-01 PPT-01 Remedial Class-01**

		of function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables Unit 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, Markov Chains, Chapman-Kolmogorov equations, classification of states			

Syllabus and Course Module for even semester 2022-23

2nd SEMESTER (HONOURS)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO OF CLASSES	Curriculum Delivery
BMH2CC03	**Real Analysis**	**Unit-1:** 1. Review of Algebraic and Order Properties of $\mathbb{R}$ 2. ε-neighbourhood of a point in $\mathbb{R}$ 3. Idea of countable sets, uncountable sets and uncountability of $\mathbb{R}$ 4. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets 5. Suprema and Infima, completeness Property of $\mathbb{R}$ and its equivalent properties 6. The Archimedean Property 7. Density of Rational (and Irrational) numbers in $\mathbb{R}$, Intervals 8. Limit points of a set, Isolated points, Open set, closed set, derived set 9. Illustrations of Bolzano-Weierstrass theorem for sets 10. Compact sets in $\mathbb{R}$, Heine-Borel Theorem	**Sanjukta Das**	**15**	**Lecture** **Tutorial** **Assignment: 01** Class test-01 PPT-01

		<u>Unit-2</u> : 1. Sequences, Bounded sequence, Convergent sequence, Limit of a sequence, lim inf, lim sup 2. Limit Theorems 3. Monotone Sequences Monotone Convergence Theorem 4. Subsequences, Divergence Criteria. 5. Monotone Subsequence Theorem (statement only) 6. Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion **<u>Unit-3</u> :** 1. Infinite series, convergence and divergence of infinite series, Cauchy Criterion 2. Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test. 3. Alternating series, Leibniz test. Absolute and Conditional convergence.	**Papia Ghosh**	**45**	**Lecture** **Tutorial** **Assignment: 01** **Class test-01** **PPT-01**

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH2CC04	**Differential Equation and Vector Calculus**	***Differential Equations :*** **Unit-1:** 1. Lipschitz condition and Picard's Theorem (Statement only) 2. General solution of homogeneous equation of second order, principle of super position for homogeneous equation 3. Wronskian: its properties and applications 4. Linear homogeneous and non- homogeneous equations of higher order with constant coefficients 5. Euler's equation 6. Method of undetermined coefficients 7. Method of variation of parameters. **Unit -2:** 1. Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients 2. Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions.	**Dr. Biswajit Paul**	**30**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-02** **Remedial Class-02**
		Vector Calculus : **Unit-3:** 1. Equilibrium points, Interpretation of the phase plane 2. Power series solution of a differential equation about an ordinary point 3. Solution about a regular singular point.	**Dr. Biswajit Paul**	**30**	

		<u>Unit- 4</u> : 1. Triple product, introduction to vector functions, operations with vector-valued functions 2. Limits and continuity of vector functions, differentiation and integration of vector functions			

2nd SEMESTER (GENERAL)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMG2CC1B	**Differential Equations**	1. First order exact differential equations 2. Integrating factors, rules to find integrating factors First order higher degree equations solvable for x,y,p 3. Methods for solving higher order differential equations 4. Basic theory of linear differential equations 5. Wronskian and its properties Solving a differential equation by reducing its order. 6. Order and degree of partial differential equations. 7. Concept of linear and non- linear partial differential equations. 8. Formation of first-order partial differential equations. 9. Linear partial differential equations of the first order. 10. Lagrange's method. 11. Charpit's method	**Papia Ghosh**	**20**	**Lecture, Tutorial, Class Test-01 PPT-01 Remedial Class-01**
		1. Linear homogeneous equations with constant coefficients.Linear non- homogeneous equations 2. The method of variation of parameters 3. The Cauchy-Euler equations Simultaneous differential equations 4. Total differential equations.	**Sanjukta Das**	**20**	**Lecture, Tutorial, Class Test-01 PPT-01 Remedial Class-01**

		5. Classification of 2nd order partial differential equations into elliptic, parabolic, and hyperbolic illustrations only			

4th SEMESTER (HONOURS)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH4CC08	**Riemann Integration and Series of Functions**	**Unit -1** : 1. Riemann integration: inequalities of upper and lower sums 2. Darbaux integration, Darbaux theorem, Riemann conditions of integrability 3. Riemann sum and definition of Riemann integral through Riemann sums, the equivalence of two Definitions. 4. Riemann integrability of monotone and continuous functions 5. Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. 6. Intermediate Value theorem for Integrals 7. Fundamental theorem of Integral Calculus **Unit-2** : 1. Improper integrals 2. Convergence of Beta and Gamma functions. **Unit-3** : 1. Pointwise and uniform convergence of sequence of functions. 2. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. 3. Series of functions, Theorems on the continuity and derivability of the sum function of a series of functions 4. Cauchy criterion for uniform convergence and Weierstrass M-Test. **Unit 4**: 1. Fourier series: Definition of Fourier coefficients and series 2. Riemann- Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition.	**Dr. Biswajit Paul**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-02** **Remedial Class-02**

		Examples of Fourier expansions and summation results for series. **<u>Unit 5</u>**: 1. Power series, radius of convergence, Cauchy Hadamard Theorem. 2. Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.			

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH4CC09	**Multivariate Calculus**	**Unit -1** : 1. Functions of several variables, limit and continuity of functions of n variables 2. Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. 3. Chain rule for one and two independent parameters 4. Directional derivatives, the gradient, Jacobian, maximal and normal property of gradient, tangent planes 5. Extrema of functions of n variables with necessary and sufficient conditions 6. Method of Lagrange multipliers. **Unit-2** : 1. Double integration over rectangular region, double integration over non-rectangular region 2. Double integrals in polar co-ordinates, Triple integrals 3. Triple integral over a parallelepiped and solid regions. 4. Volume by triple integrals, cylindrical and spherical coordinates. 5. Change of variables in double integrals and triple integrals. **Unit-3** : 1. Vector operators, Gradient of a scalar function, directional derivatives 2. Definition of vector field, divergence and curl. 3. Line integrals, Fundamental theorem for line integrals, conservative vector fields 4. Application of line integral to Workdone. **Unit 4**: 1. Green's theorem, surface	**Papia Ghosh**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

		integrals, integrals over parametrically defined surfaces. 2. Stoke's theorem 3. The Divergence theorem.			

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH4CC10	**Ring Theory and Linear Algebra I**	**Unit -1** : 1. Definition and examples of rings, properties of rings 2. Subrings, integral domains and fields, characteristic of a ring. 3. Ideal, ideal generated by a subset of a ring, factor rings, operations on ideals, prime and maximal ideals. **Unit-2** : 1. Ring homomorphisms, properties of ring homomorphisms. 2. Isomorphism theorems I, II and III, field of quotients. **Unit-3** : 1. Vector spaces, subspaces, algebra of subspaces, quotient spaces 2. Linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces, extension, deletion and replacement theorems. **Unit 4**: 1. Linear transformations, null space, range, rank and nullity of a linear transformation 2. Matrix representation of a linear transformation, algebra of linear transformations 3. Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.	**Sanjukta Das**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH 4SEC 21	**Graph Theory**	**Unit -1** : 1. Definition, examples and basic properties of graphs 2. Pseudo graphs, complete graphs, bi-partite graphs isomorphism of graphs. **Unit-2** : 1. Eulerian circuits, Eulerian graph, semi-Eulerian graph and theorems 2. Hamiltonian cycles and theorems 3. Representation of a graph by a matrix, the adjacency matrix, incidence matrix, weighted graph **Unit-3** : 1. Travelling salesman's problem, shortest path 2. Tree and their properties, spanning tree 3. Dijkstra's algorithm 4. Warshall algorithm	**Dr. Biswajit Paul**	**40**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

4^{th} SEMESTER (GENERAL)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMG4CC1D	**Algebra**	1. Definition and examples of group 2. Examples of abelian and non- abelian groups 3. The group $\mathbb{Z}n$ of integers under addition modulo n and the group U(n) of units under multiplication modulo n 4. Cyclic group from number system 5. Complex roots of unity 6. Circle group 7. General linear group $GLn(\mathbb{R})$ 8. Groups of symmetries of (i) an isosceles triangle (ii) an equilateral triangle, (iii) a rectangle, and (iv) square 9. The permutation groups in n 10. Group of quaternions	**Dr. Biswajit Paul**	40	**Lecture, Tutorial, Class Test-01 PPT-01 Remedial Class-01**
		1. Subgroups 2. Cyclic subgroups 3. The concept of a subgroup generated by a subset and the commutator subgroup of the group 4. Examples of subgroups including the center of a group 5. Cosets index of the subgroup 6. Lagrange's theorem 7. Order of an element 8. Normal subgroups: their definitions, examples, and characterization 9. Quotient group	**Dr. Biswajit Paul**		
		1. Definition and examples of rings 2. Examples of commutative and non-commutative rings 3. Rings from the number system	**Dr. Biswajit Paul**		

		4. $\mathbb{Z}n$ the ring of integer modulo n 5. Ring of real quaternions			
		1. Rings of matrices 2. Polynomial rings and rings of continuous functions 3. Subrings and ideals Integral domains and fields 4. Examples of fields: $\mathbb{Z}p$, $\mathbb{Q}$, $\mathbb{R}$, $\mathbb{C}$. 5. Field of rational functions.	**Dr. Biswajit Paul**		

6th SEMESTER (HONOURS)

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH6CC13	**Metric Spaces and Complex Analysis**	***Metric Spaces:*** **Unit 1 :** 1. Metric spaces: Sequences in Metric Spaces 2. Cauchy sequences. 3. Complete Metric Spaces 4. Cantor's theorem. **Unit 2 :** 1. Continuous mappings, sequential criterion and other characterizations of continuity 2. Uniform continuity 3. Connectedness, connected subsets of R. 4. Compactness: Sequential compactness, Heine-Borel property 5. Totally bounded spaces, finite intersection property 6. Continuous functions on compact sets. 7. Homeomorphism 8. Contraction mappings 9. Banach Fixed point Theorem and its	**Dr. Biswajit Paul**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

		application to ordinary differential equation.			
		Complex Analysis: **Unit 3 :** 1. Limits, Limits involving the point at infinity, continuity. 2. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. 3. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability. **Unit 4 :** 1. Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, and definite integrals of functions. 2. Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. 3. Cauchy- Goursat theorem, Cauchy integral formula. **Unit 5 :** 1. Liouville's theorem and the fundamental theorem of algebra. 2. Convergence of sequences			

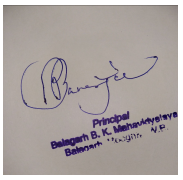
		and series 3. Taylor series and its exampleS **<u>Unit 6</u> :** 1. Laurent series and its examples 2. Absolute and uniform convergence of power series.			

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH6CC14	**Ring Theory and Linear Algebra II**	**Unit 1 :** 1. Polynomial rings over commutative rings, division algorithm and consequences 2. Principal ideal domains, factorization of polynomials, reducibility tests, irreducibility tests, Eisenstein criterion and unique factorization in $\mathbb{Z}[x]$. 3. Divisibility in integral domains, irreducible, primes, unique factorization domains 4. Euclidean domains. **Unit 2 :** 1. Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, annihilators. 2. Eigen spaces of a linear operator 3. Diagonalizability, invariant subspaces 4. Cayley-Hamilton theorem, the minimal polynomial for a linear operator, canonical forms. **Unit 3 :** 1. Inner product spaces and norms 2. Gram-Schmidt orthogonalization process, orthogonal complements 3. Bessel's inequality, the adjoint of a linear operator 4. Least Squares Approximation, minimal solutions to systems of linear equations 5. Normal and self-adjoint	**Sanjukta Das**	**60**	**Lecture,** **Tutorial,** **Class Test-01** **PPT-01** **Remedial Class-01**

		operators 6. Orthogonal projections and Spectral theorem.			

COURSE CODE	COURSE NAME	SUBJECT TOPICS	TEACHER'S NAME	NO. OF CLASSES	Curriculum Delivery
BMH6DSE43	**Mechanics II**	**Unit 1 :** 1. Interpretation of Newton's laws of motion 2. Galilean transformation 3. Concept of absolute length and time 4. Limitations of Newton's laws in solving problems. **Unit 2 :** 1. Equilibrium of fluid in a given field of force 2. Pressure in a heavy homogeneous liquid 3. Equilibrium of floating bodies 4. Isothermal and adiabatic changes in Gases 5. Convective equilibrium 6. Stress in continuum body 7. Stress quadric. **Unit 3 :** 1. Constraints and their classifications 2. Lagrange's equation of motion for holonomic system 3. Gibbs-Appell's principle of least constraint 4. Work energy relation for constraint forces of shielding friction.	**Papia Ghosh**	**60**	**Lecture, Tutorial, Class Test-01 PPT-01 Remedial Class-01**
BMH6PW01	**Project Work**		Papia Ghosh	60	**Lecture, Tutorial, Class Test-01**

					PPT-01 **Remedial** **Class-01**



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