Module for Mathematics (Honours)
Session: 2022 – 2023

Teacher's name: Dr. Sabina Eyasmin

Odd (1st, 3rd, 5th) Semester

1st Semester				
Months	**Paper**	**Unit**	**Topics**	**No. of classes**
September 2022	BMH1CC01	1	Hyperbolic functions, 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* etc.	6
October 2022	BMH1CC01	1	Concavity and inflection points of functions, envelopes of family of curves, asymptotes of a plane curve ,	9
			Revision and Question answer session and class-test	3
November 2022	BMH1CC01	1	curve tracing in Cartesian coordinates, tracing of various standard curves in polar coordinates, L'Hospital's rule, applications in solving several problems.	9
			Revision and Question answer session and class-test	3
December 2022	BMH1CC01	2	Reduction formulae, derivations and illustrations of reduction formulae for the integration of *sin nx, cos nx, tan nx, sec nx, sin^n x sin^m x* etc. Parametric equations	9
			Revision and Question answer session and class-test	3
January 2023	BMH1CC01	2	Parametrizing a curve with several examples, arc length, finding arc length of parametric curves, finding area of surface of revolution.	9
			Revision and Question answer session and class-test	3

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3rd Semester				
Months	**Paper**	**Unit**	**Topics**	**No. of classes**
August 2022	BMH3CC05	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.	16
			Revision and Question answer session	4
September 2022	BMH3CC05	1	Intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, theorems on uniform continuity,	8
		2	Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum.	8
			Revision and Question answer session	4
October 2022	BMH3CC05	2	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.	14
		3	Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder.	2
			Revision and Question answer session and class test	4
November 2022	BMH3CC05	3	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 expansion of various functions about some real number.Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, ln (1+x), 1/(ax+b), (1+x)^n, sin x etc. and other functions. Application of Taylor's theorem to inequalities.	16
			Revision and Question answer session and class test	4
December 2022	BMH3CC05	4	A quick overview in real analysis. Review several properties of sets in R, Introduction to Metric space by several examples.	6
		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.	10
			Revision and Question answer session and class test	4
January 2023	BMH3CC05		Revision, discussion and question answer session for all units and class test.	15

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5th Semester				
Months	**Paper**	**Unit**	**Topics**	**No. of classes**
August 2022	BMH5DSE21	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.	16
			Revision and Question answer session.	4
September 2022	BMH5DSE21	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.	16
			Revision and Question answer session.	4
October 2022	BMH5DSE21	2	Correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.	6
		3	Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers.	10
			Revision and Question answer session and class test.	4
November 2022	BMH5DSE21	3	Central Limit theorem for independent and identically distributed random variables with finite variance, Markov Chains,Chapman-Kolmogorov equations, classification of states.	16
			Revision and Question answer session and class-test.	4
December 2022	BMH5DSE21	4	Random Samples, Sampling Distributions, Estimation of parameters,Null hypothesis, accept/reject null hypothesis based on critical value and significance level, Testing of hypothesis. Several problems of testing hypothesis.	16
			Revision and Question answer session and class-test.	4

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Even (2nd, 4th, 6th) Semester

2nd Semester				
Months	**Paper**	**Unit**	**Topics**	**No. of classes**
March 2023	BMH2CC03	I	Set theory, real numbers, sets in $\mathbb{R}$, real functions, Review of Algebraic and Order Properties of $\mathbb{R}$,	9
			Revision and Question answer session and class-test	3
April 2023	BMH2CC03	I	ϵ-neighbourhood of a point in $\mathbb{R}$, Idea of countable sets, uncountable sets and uncountability of $\mathbb{R}$. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets. Suprema and Infima.Completeness Property of $\mathbb{R}$ and its equivalent properties.	9
			Revision and Question answer session and class-test	3
May 2023	BMH2CC03	I	The Archimedean Property, Density of Rational (and Irrational) numbers in $\mathbb{R}$, Intervals. Limit points of a set, isolated points, Open set, closed set, derived set, Illustrations of Bolzano-Weierstrass theorem for sets, compact sets in $\mathbb{R}$, Heine-Borel Theorem.	9
			Revision and Question answer session and class-test	3
June 2023	BMH2CC03		Graphical Demonstration: Plotting of recursive sequences. Study the convergence of sequences through plotting, Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.	9
			Revision and Question answer session and class-test	3
July 2023	BMH2CC03		Graphical Demonstration: Study the convergence/divergence of infinite series by plotting their sequences of partial sum, Cauchy's root test by plotting nth roots, Ratio test by plotting the ratio of nth and (n+1)th term.	9
			Revision and Question answer session of all units	3

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4th Semester				
Months	**Paper**	**Unit**	**Topics**	**No. of classes**
February 2023	BMH4CC08	1	Riemann integration: inequalities of upper and lower sums, Darbaux integration, Darbaux theorem, Riemann conditions of integrability, Riemann sum and definition of Riemann integral through Riemann sums, equivalence of two Definitions.	16
			Revision and Question answer session.	4
March 2023	BMH4CC08	1	Riemann integrability of monotone and continuous functions, Properties of the Riemann integral; definition and integrability of piecewise continuous and monotone functions. Intermediate Value theorem for Integrals, Fundamental theorem of Integral Calculus.	16
			Revision and Question answer session and class-test	4
April 2023	BMH4CC08	2	Improper integrals, Convergence of Beta and Gamma functions.	4
		3	Pointwise and uniform convergence of sequence of functions. Theorems on continuity, derivability and integrability of the limit function of a sequence of functions. Series of functions, Theorems on the continuity and derivability of the sum function of a series of functions; Cauchy criterion for uniform convergence and Weierstrass M-Test.	12
			Revision and Question answer session and class-test	4
May 2023	BMH4CC08	4	Fourier series: Definition of Fourier coefficients and series, Riemann- Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition. Examples of Fourier expansions and summation results for series.	16
			Revision and Question answer session and class-test	4
June 2023	BMH4CC08	5	Power series, radius of convergence, Cauchy Hadamard Theorem. Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.	16
			Revision and Question answer session of all units	4

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6th Semester

Months	Paper	Unit	Topics	No. of classes
February 2023	BMH6DSE42	1	Theory of Space Curves: Space curves, Planer curves, Curvature, torsion and Serret-Frenet formula, Osculating circles, Osculating circles and spheres, Existence of space curves, Evolutes and involutes of curves.	17
			Revision and Question answer session.	3
March 2023	BMH6DSE42	2	Theory of Surfaces: Parametric curves on surfaces, Direction coefficients, First and second Fundamental form	16
			Revision and Question answer session and class-test	4
April 2023	BMH6DSE42	2	Principal and Gaussian curvatures, Lines of curvature, Euler's theorem, Rodrigue's formula, Conjugate and Asymptotic lines	15
			Revision and Question answer session and class-test	3
	Project		Instruction for Project work	2
May 2023	BMH6DSE42	3	Developables: Developable associated with space curves and curves on surfaces, Minimal surfaces, Geodesics: Canonical geodesic equations, Nature of geodesics on a surface of revolution.	14
			Revision and Question answer session and class-test	3
	Project		Instruction for completing Project work	3
June 2023	BMH6DSE42	3	Clairaut's theorem, Normal property of geodesics, Torsion of a geodesic, Geodesic curvature, Gauss-Bonnet theorem.	8
			Revision and Question answer session of all units and class-test	8

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Module for Mathematics (General)
Session: 2022 – 2023

Teacher's name: Dr. Sabina Eyasmin

5th Semester			
Months	**Paper**	**Topics**	**No. of classes**
Auguest 2022	SEC31	Sample space, probablity axioms, real random variables (discrete and continuous), cumulative distribution function, probablity mass/density function ,Mathematical expextation, moments, moments generating functions, characteristic functions.	16
		Revision and Question answer session	4
September 2022	SEC31	Discrete distributions: uniform, binomial, Poisson, continuous distribution: uniform, normal, exponential,Joint cumulative distribution functions and its properties	16
		Revision and Question answer session and class-test	4
October 2022	SEC31	Joint probablity density functions, marginal and conditional distributions	8
		Revision and Question answer session and class-test	4
November 2022	SEC31	Expectation of a function of two random variables, conditional expectation	8
		Revision and Question answer session and class-test	4
December 2022	SEC31	Independent random variables, and solving several problems of probablity theory	4
		Revision and Question answer session for all units and class-test	8

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6th Semester			
Months	**Paper**	**Topics**	**No. of classes**
February 2023	DSE1B3	Introduction to Linear Programming problems(LPP). Graphical approach for solving some LPPs.Convex sets, supporting and separating Hyperplanes.	14
		Revision and Question answer session	2
March 2023	DSE1B3	Theory of Simplex Method, simplex algorithm,two-phase method,Big-M method and their comparison.	14
		Revision and Question answer session and class-test	2
April 2023	SEC43	Definition, example and basic properties of graphs, pseudographs, complete graphs, bi partitegraphs, isomorphism of graphs, paths and circuits, Eulerian circuits, Hamiltonian cycles,	14
		Revision and Question answer session and class-test	2
May 2023	SEC43	the adjacency matrix,weighted graph, travelling salesman's problem,shortestpath, Dijkstra'salgorithm,Floyd-Warshall algorithm.	14
		Revision and Question answer session and class-test	2
Jun-23	DSE1B3 & SEC43	Revision and Question answer session for all papers and class-test	12

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Module

Mathematics (Hons) 1st Semester (2022-23)

Bipattaran Raj

Months	Paper	Unit	Topics	No. of classes
September	CC01	IV	Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation.	04
October	CC01	III& IV	Exact differential equations and integrating factors, separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factor and transformations. Reflection properties of conics, translation and rotation of axes and second- degree equations.	10
November	CC01	III	Classification of conics using the discriminant, polar equations of conics. Spheres, Cylindrical surfaces, Central conicoids, Paraboloids, plane sections of conicoids.	16
December	CC01	III	Generating lines, Classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.	15
January	CC01	All units	Revision and Question answer session	14

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Module

Mathematics (Hons) 2nd Semester (2022-23)

Bipattaran Raj

Months	Paper	Unit	Topics	No. of classes
March	CC04	IV	Equilibrium points, Interpretation of the phase plane. Power series solution of a differential equation about an ordinary point, solution about a regular singular point. Triple product.	10
April	CC04	IV	Introduction to vector functions, operators with vector- valued functions,limits and continuity of vector functions, differentiation and integration of vector functions.	12
May	CC04	III	Equilibrium points, interpretation of the phase plane, Power series solution of a differential equation about an ordinary point, solution about a regular singular point.	11
June	CC04	III	Graphical Demonstration. Revision and Question answer session	09

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Mathematics (Hons) 3rd Semester (2022-23)

Bipattaran Raj

Months	Paper	Unit	Topics	No. of classes
August	Sec11	Unit-I	Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional proposition, converse, Contra positive and inverse propositions and precedence of logical operators.	11
September	Sec11	Unit-I	Propositional equivalence, Logical equivalences. Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.	10
October	Sec11	Unit-II	Sets, Subsets, Set operations and the laws of set theory and Venn diagrams.	03
November	Sec11	Unit-II	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.	10
December	Sec11	Unit III	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.	11

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Mathematics (Hons) 4th Semester (2022-23)

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Months	Paper	Unit	Topics	No. of classes
February	CC09	I	Functions of several variables, limit and continuity of functions of n variables, Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives, the gradient, Jacobian,	08
March	CC09	I &II	Maximal and normal property of gradient, tangent planes, Extrema of function of n variables with necessary and sufficient conditions, method of Lagrange multipliers. Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates.	12
April	CC09	II &III	Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates. Change of variables in double integrals and triple integrals. Vector operators, Gradient of a scalar function, directional derivatives, Definition of vector field, divergence and curl.	11
May	CC09	III	Line integrals, Fundamental theorem for line integrals, conservative vector fields, Application of line integral to Work done. Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.	12
June	CC09	All Units	Revision.	13

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Mathematics (Hons) 5th Semester (2022-23)

Bipattaran Raj

Months	Paper	Unit	Topic	No. of classes
August	CC12	I	Co-planer forces, Astatic equilibrium, Friction, Equilibrium of a particle on a rough curve, Virtual work, Forces in 3- dimensions, General condition of equilibrium, Centre of gravity for different bodies, Stable and Unstable equilibrium, Equilibrium of flexible string.	16
September	CC12	II	Simple Harmonic Motion, Damped and forced vibrations, Components of velocity and acceleration, Equations of motion referred to a set of rotating axis. Motion of projectile in a resisting medium, Motion of a particle under central force.	15
October	CC12	II	Kepler's laws of motion, motion under the inverse square law, Stability of nearly circular orbits, Slightly disturbed orbits, Motion of Artificial satellite.	05
November	CC12	II & III	Varying mass, constraint, Motion of a particle in 3- dimensions, Motion on a smooth sphere, cone and on any surface revolutions, Degrees of freedom, Moment and Product of Inertia, Momentum ellipsoid, Principal axes.	16
December	CC12	III	D'Alembert's Principal , Motion about a fixed axes, Compound pendulum, Motion of a system of particles, Motion of a rigid body in 2- dimensions, under finite and impulsive forces, conservation of momentum and energy	15

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Module

Mathematics (Hons) 6th Semester (2022-23)

Bipattaran Raj

Months	Paper	Unit	Topic	No. of classes
February	CC14	II	Dual spaces, dual basis, double dual, transpose of a linear transformation and its matrix in the dual basis, Annihilators.	12
March	CC14	II	Eigen spaces of a linear operator, Diagonalizability, Invariant subspaces and Cayley- Hamilton theorem, The minimal polynomial for a linear operator, Canonical form.	14
April	CC14	III	Inner Product spaces and norms Gram-Schmidt orthogonalization process, Orthogonal complement, Bessel's inequality, the adjoint of a linear operator, Leastsquare approximations. minimal solutions to system of linear equations.	14
May	CC14	III	Normal and Self adjoin operators, Orthogonal projections and spectral theorem, Revision and Question Answer session.	10

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Module

Mathematics (Hons.) 1st Semester (2022-23).

Prof. Bhaskar Ghosh.

Months	Paper	Unit	Topics	No. of classes
September	CC02	I	Polar representation of complex numbers, n-th roots of unity, De- Moivre's theorem for rational indices and its applications.	05
October	CC02	I	Theory of equations: Relation between roots and coefficients, Transformation of equation, Descartes rule of signs, Cubic and bi-quadratic equations. Reciprocal equation, separation of the roots of equations, Strum,s theorem.	09
November	CC02	I & II	Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality. Equivalence relations and partitions, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set	15
December	CC02	II	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.	14
January	CC02	II	Revision and Question answer session.	12

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Module

Mathematics (Hons) 2nd Semester (2022-23)

Prof. Bhaskar Ghosh.

Months	Paper	Unit	Topics	No. of classes
March	CC03	II	Sequences. Bounded sequence. Convergent sequence. Limit of a sequence. limit –inf . limit- sup. Limit Theorems. Monotone Sequences. Monotone Convergence Theorem. Subsequences. Divergence Criteria. Monotone Subsequence Theorem (statement only)	13
April	CC03	II	Bolzano Weierstrass Theorem for Sequences. Cauchy sequence. Cauchy's Convergence Criterion. Cauchy's first and second theorem on limit.	12
May	CC03	III	Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test. Cauchy's nth root test, Integral test.	14
June	CC03	III & All units	Alternating series, Leibniz test. Absolute and Conditional convergence. Revision and Question answer session.	12

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Mathematics (Hons.) 3rd Semester (2022-23)

Prof. Bhaskar Ghosh

Months	Paper	Unit	Topics	No. of classes
August	CC07	I& IV	Algorithm, Convergence, Errors: Relative & Absolute, Round off. Interpolation: Lagrange and Newton's method Error bounds. Finite difference operators. Gregory forward and backward difference interpolations. Numerical differentiation: Methods based on interpolations methods based on finite differences.	13
September	CC07	II	Regula- Falsi method, Fixed point iteration, Newton-Raphson method, Rate of convergence of these methods. Truncation, Transcendental and Polynomial equation, Bisection method, Newton's method, Secant method,	14
October	CC07	III	System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method. Gauss Seidel method and their convergence analysis. LU Decomposition.	08
November	CC07	III & V	Ordinary Differential Equations: The method of successive approximations, Euler's method, the modified Euler method, Runge- Kutt method of orders two and four.	13
December	CC07		Revision and question answer session.	08

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Mathematics (Hons.) 4th Semester (2022-23)

Prof. Bhaskar Ghosh

Months	Paper	Unit	Topics	No. of classes
February	CC10	I	Definition and examples of rings, properties of rings, subrings, integral domains and fields, characteristic of a ring. Ideal, ideal generated by a subset of a ring, factor rings,	10
March	CC10	II & III	Operations on ideals, prime and maximal ideals. Ring , homomorphisms, properties of ring homomorphism's. Isomorphism theorems I, II and III, field of quotients.	13
April	CC10	III & IV	Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span. Linear independence, basis and dimension, dimension of subspaces, extension, deletion and replacement theorems.	14
May	CC10	IV	Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.	12
June	CC10	IV	Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix. Revision and question answer session	13

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Mathematics (Hons) 5th Semester (2022-23)

Prof. Bhaskar Ghosh

Months	Paper	Unit	Topics	No. of classes
August	DSE11	I	Introduction to linear programming problem. Theory of simplex method, graphical solution, convex sets, optimality and unboundedness.	5
September	DSE11	I	The simplex algorithm, simplex method in tableau format, introduction to artificial variables, two-phase method. Big-M method and their comparison.	12
October	DSE11	II	Duality, formulation of the dual problem, primal-dual relationships, economic interpretation of the dual, Dual Simplex method.	10
November	DSE11	III	Transportation problem and its mathematical formulation, northwest-corner method, least cost method and Vogel approximation method for determination of starting basic solution.	6
			Algorithm for solving transportation problem, assignment problem and its mathematical formulation, Hungarian method for solving assignment problem, Travelling salesman problem.	10
December	DSE11	IV	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.	12
December	DSE11		Revision and Question answer session	04

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Mathematics (Hons) 6th Semester (2022-23)

Prof. Bhaskar Ghosh

Months	Paper	Unit	Topics	No. of classes
February	CC13	I	Sequences in Metric Spaces, Cauchy sequences. Complete Metric Spaces, Cantor's theorem..	12
March	CC13	I	Continuous mappings, sequential criterion and other characterizations of continuity, Uniform continuity, Connectedness, connected subsets of R.	12
April	CC13	II	Compactness: Sequential compactness, Heine-Borel property, Totally bounded spaces, finite intersection property, 27 and continuous functions on compact sets.	14
May	CC13	II & All units	Homeomorphism, Contraction mappings, Banach Fixed point Theorem and its application to ordinary differential equation.	12
June	CC13		Revision and Question answer session	12

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Mathematics (Hons.) 1st Semester (2022-23).

Prof. Arghya Ghosh

Months	Paper	Unit	Topics	No. of classes
September	CC02	III	Systems of linear equations. Row reduction and echelon forms.	5
October	CC02	III & IV	Vector equations, the matrix equation Ax=b, Solution Sets of linear Systems, applications of linear systems, linear independence. Introduction of linear transformations.	9
November	CC02	IV	Matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrix. Vector Spaces of R^n, Subspaces of R^n,dimension of Subspaces of R^n, rank of a Matrix.	12
December	CC02	IV	Eigen Values, Eigen Vectors and Characteristic equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix.	14
January	CC02	All units	Revision and Question answer session.	12

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Mathematics (Hons.) 2nd Semester (2022-23)

Prof. Arghya Ghosh

Months	Paper	Unit	Topics	No. of classes
March	CC04	I	**Lipschitz** condition and Picard's theorem. General solution of homogeneous equation of second order. Principle of super position for homogeneous equation, Wronskian: its properties and applications. Linear homogeneous and non-homogeneous equations of higher order with constant coefficients.	12
April	CC04	I & II	Euler's equation, method of undetermined coefficient, method of variation of parameters, Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients.	13
May	CC04		Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients. Two Equations in two unknown functions.	14
June	CC04	I,II & All units	Revision and Question answer session.	10

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Mathematics (Hons.) 3rd Semester (2022-23)

Prof. Arghya Ghosh

Months	Paper	Unit	Topics	No. of classes
August	CC06	I & II	Symmetries of square, Dihedral groups. Examples of groups including permutation groups and quaternion groups, elementary properties of groups, Subgroups and examples of Subgroups, centralizer, normalize, centre of a group, product of two subgroups	15
September	CC06	III	. Properties of cyclic groups, classification of subgroups of cyclic groups, cycle notation for permutations, properties of permutations, even and permutations, alternating groups.	14
October	CC06	III	Properties of cosets, Lagrange's theorem and consequences including Fermat's Little theorem	05
November	CC06	IV	External direct product of a finite number of groups, normal groups, factor groups, Cauchy's theorem for finite abelian groups.	14
December	CC06	V	Group homomorphism, properties of homomorphism, Cayley's theorem, properties of isomorphism, First isomorphism theorem.	13

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Mathematics (Hons.) 4th Semester (2022-23)

Prof. Arghya Ghosh

Months	Paper	Unit	Topics	No. of classes
February	SEC21	I	Definition, examples and basic properties of graphs, Pseudo graphs, complete graphs, bi-partite graphs. Isomorphism of graphs	13
March	SEC21	II	Eulerian circuits, Eulerian graph, semi-Eulerian graph and theorems, Hamiltonian cycles and theorems. Representation of a graph by a matrix. The adjacency matrix, incidence matrix, weighted graph.	15
April	SEC21	III	Travelling salesman's problem, shortest path, tree and their properties, spanning tree. Dijkstra's algorithm, Warshall algorithm.	13
May	SEC21	All units	. Revision and question answer session.	14

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Module

Mathematics (Hons.) 5th Semester (2022-23)

Prof. Arghya Ghosh.

Months	Paper	Unit	Topics	No. of classes
August	CC11	I	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 form of First-order linear Equations.	14
September	CC11	I & II	Method of Separation of Variable for solving first order partial Differential Equations. Derivation of Heat, Wave and Laplace equation. Classification of second order linear equations as hyperbolic, parabolic.	15
October	CC11	II	Classification of second order linear equation as elliptic. Reduction of second order Linear Equations to Canonical forms.	05
November	CC11	III	The Cauchy problem of second 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, Semi-infinite string with a free end.	16
December	CC11	III	Equations with non-homogeneous boundary conditions. Non-homogeneous Wave Equation. Method of Separable of variables: Solving the Vibrating string problem. Solving the Heat conduction problem. Graphical Demonstration	15

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Module

Mathematics (Hons.) 6th Semester (2022-23)

Prof. Arghya Ghosh

Months	Paper	Unit	Topics	No. of classes
February	CC13	III & IV	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. Analytic functions, Examples of analytic functions, exponential function, Logarithmic function, trigonometric function.	12
March	CC13	IV & V	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. Liouville's theorem and the fundamental theorem of algebra.	13
April	CC13&CC14	V , VI &I	Convergence of sequences and series. Taylor series and its examples. Laurent Series and its examples. Absolute and uniform convergence of power series. Polynomial rings over commutative rings, division algorithm and consequences, Principal ideal domain.	13
May	CC14	I	Factorization of polynomials, reducibility and irreducibility tests, Eisenstein criterion and unique factorization in $Z[x]$. Divisibility in integral domains, irreducible, primes, unique factorization domains, Euclidean domain &	13
June	CC13 & CC14	All units	Revision and Question answer session	12

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