



গড়গাঁও মহাবিদ্যালয় GARGAON COLLEGE

TEACHING PLAN
DEPARTMENT OF MATHEMATICS
JULY 2020 - JUNE 2021



গড়গাঁও মহাবিদ্যালয়

GARGAON COLLEGE

GARGAON COLLEGE

TEACHING PLAN

Course: B.A./B. SC.

Session: Odd semester 2020 (July-December)

Subject: MATHEMATICS

Name of the Teacher: Dr. Kabita Phukon

Methods to be applied: Lecture, analytical and activity method, interaction and discussion.

Teaching Materials: White Board, Marker Pen, Duster, Books, Journals, Laptop, Projector

Paper Code/ Title	Allotted Unit	No. of Classes Required	Details of the topics to be taught	No. of Tutorials
C1: Calculus	Unit-1	16	20 Hyperbolic functions, higher order derivatives, Leibniz rule and its applications to problems of type $\sin x$, e , $\cos x$, $(ax + b)$, $n \sin x$, $(ax+b)$, $\cos x$, concavity and inflection points, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospitals rule, applications of maxima and minima.	4
C2: Algebra	Unit-2	25	Equivalence relations, 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.	5
GE-1: Differential Calculus	Unit-1	25	Limit and Continuity (ϵ and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.	5
C6: Group Theory I	Unit-1	16	Symmetries of a square, Dihedral groups, definition and examples of groups including permutation groups and quaternion groups (illustration through matrices), elementary properties of groups.	4
	Unit-2	12	Subgroups and examples of subgroups, centralizer, normalizer, center of a group, product of two subgroups.	3
	Unit-3	15	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 theorem.	5
	Unit-4	15	External direct product of a finite number of groups, normal subgroups, factor groups, Cauchy's theorem for finite abelian groups.	5
	Unit-5	11	Group homomorphisms, properties of homomorphisms, Cayley's theorem, properties of isomorphisms, First, Second and Third isomorphism theorems.	4

GE-3: Real Analysis	Unit-1	23	Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of \mathbb{R} , Archimedean property of \mathbb{R} , intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.	7
	Unit-2	14	Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).	6
MM503: Hydro Dynamics	Unit-1	7	Kinematics: Real and ideal fluid, velocity of a fluid at a point, Eulerian and Lagrangian method, stream lines and path lines, steady and unsteady flows, velocity potential, rotational and irrotational motions, local and particle rate of change, equation of continuity, examples, acceleration of a fluid at a point, General analysis of fluid motion.	2
	Unit-2	5	Equation of Motion: Euler's equation of motion, Bernoulli's equation, steady motion under conservative forces, impulsive motion, circulation, Kelvin's circulation theorem.	2
	Unit-3	4	General theory of irrotational motion: Potential flow, deductions from Green's theorem, kinetic energy of a liquid, uniqueness theorems, Kelvin's minimum energy theorem, Mean value of velocity potential.	1
MM503: Hydro Statics	Unit-1	8	Fluid Pressure: Introduction, Fluid Pressure and related theorems, Density and specific gravity, Theorems on fluid pressure under gravity, Rate of variation of pressure, Differential equation of pressure, Condition of equilibrium, Equi-pressure surfaces and lines of force, Curves of equi-pressure and equi-density, Examples.	3
	Unit-2	9	Resultant Pressure and Centre of Pressure: Resultant fluid pressure and related theorems, Centre of pressure, Determination of centre of pressure of parallelogram, triangle, circle under different conditions, Examples, Thrust on curved surfaces, Examples.	2
	Unit-3	5	Equilibrium and Stability of Floating Bodies: Condition of equilibrium of floating bodies, Examples, Unstable and Neutral equilibrium, Determination of Meta centre, Examples.	2


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GARGAON COLLEGE**TEACHING PLAN**

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Session: Even semester 2021 (January-June)

Subject: MATHEMATICS**Name of the Teacher:** Dr. Kabita Phukon**Methods to be applied:** Lecture, activity method, interaction, and discussion.**Teaching Materials:** White Board, Marker Pen, Duster, Books, Journals, Laptop, Projector

Paper Code/ Title	Allotted Unit	No. of Class Required	Details of the topics to be taught	No. of Tutorials
C4: Differential Equations	Unit-1	10	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.	5
	Unit-3	20	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, Euler's equation, method of undetermined coefficients, method of variation of parameters.	5
GE-2: Differential Equation	Unit-1	10	First order exact differential equations. Integrating factors, rules to find an integrating factor.	5
	Unit-3	15	Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.	5
C8: Numerical Methods	Unit-1	4	Algorithms, Convergence, Errors: Relative, Absolute, Round off, Truncation.	1
	Unit-2	8	Transcendental and Polynomial equations: Bisection method, Newton's method, Secant method. Rate of convergence of these methods.	2
	Unit-3	7	System of linear algebraic equations: Gaussian Elimination and Gauss Jordan methods. Gauss Jacobi method, Gauss Seidel method and their convergence analysis.	3
	Unit-4	8	Interpolation: Lagrange and Newton's methods. Error bounds. Finite difference operators. Gregory forward and backward difference interpolation.	2
	Unit-5	13	Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpsons 3/8th rule, Boole's Rule. Midpoint rule, Composite Trapezoidal rule, Composite Simpson's rule.	2
	Unit-6	9	Ordinary Differential Equations: Euler's method. Runge-Kutta methods of orders two and four.	1
	Practical	16	(i) Calculate the sum $1/1 + 1/2 + 1/3 + 1/4 +$	4

			<p>-----+ 1/N.</p> <p>(ii) To find the absolute value of an integer.</p> <p>(iii) Enter 100 integers into an array and sort them in an ascending order.</p> <p>(iv) Bisection Method.</p> <p>(v) Newton Raphson Method.</p>	
GE-4: Algebra	Unit-1	25	Definition and examples of groups, examples of abelian and non-abelian groups, the group Z_n of integers under addition modulo n and the group $U(n)$ of units under multiplication modulo n . Cyclic groups from number systems, complex roots of unity, circle group, the general linear group $GL_n(n, R)$, groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group $Sym(n)$, Group of quaternions.	5

MM603: Algebra II	Unit-1	5	Automorphism of groups, Inner automorphism, external and internal direct products.	2
	Unit-2	7	Definition and examples of Ring, Special kinds of rings, sub rings and ideals, sum and product of ideals.	2
	Unit-3	6	Quotient Ring, Homomorphism of ring, Imbedding of rings, Maximal and Prime ideal.	3
MM603: PDE	Unit-1	10	Introduction, Origins of First order PDE, Cauchy Problem for First order equations, Linear equations of first order, Lagrange equation, Integral Surface passing through a given curve, surface orthogonal to a given system of surfaces.	3
	Unit-2	10	Nonlinear PDE of first order, Cauchy Method of characteristics, Compatible systems of first order equation, Charpit's Method, special types of first order equations, solution satisfying given conditions, Jacobi's Method.	2


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TEACHING PLAN

Course: B.A./B. SC.

Session: Odd semester 2020 (July-December)

Subject: MATHEMATICS

Name of the Teacher: Mr. Harekrishna Mili

Methods to be applied: Lecture, analytical and activity method, interaction and discussion.

Teaching Materials: White Board, Marker Pen, Duster, Books, Journals, Laptop, Projector, Smart Tv

Paper Code/ Title	Allotted Unit	No. of Classes Required	Details of the topics to be taught	No. of Tutorials
C1: Calculus	Unit-2	8	Reduction Formulae of the types $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$, $\int (\log x)^n dx$ and $\int \sin^n x \cos^n x dx$ and their derivations. Rectification, volume and surface area of revolution of a curve.	4
GE-1: Differential Calculus	Unit-2	10	Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.	6
C5: Theory of Real Function	Unit-1	25	Limits of functions (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, uniform continuity theorem.	5
	Unit-2	24	Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. 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, Taylor's theorem to inequalities.	6
	Unit-3	26	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 n and Maclaurin's series expansions of	4

			exponential and trigonometric functions, $\ln(1+x)$, $1/ax+b$ and $(1+x)$	
GE-3: Real Analysis	Unit-3	15	Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.	5
	Unit-4	14	Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.	6

MM501: Logic	Unit-1	5	The Statement Calculus: Introduction, Sentential Connectives, Truth tables, Truth value, Validity, truth function, tautology and related theorems, arithmetic representation of sentential connectives.	1
	Unit-2	1	Theory of Inference: Consequence, rule of inference and applications. Predicate calculus: symbolizing language.	2
MM501: Combinatorics	Unit-1	4	Fundamental Principles of Counting: Binomial Theorem, Pascal and Vander Monde's identity, Multinomial theorem, Ramsey number, Catalan numbers, Stirling and Bell number.	1
	Unit-2	5	The principles of Inclusion-Exclusion: The principles of Inclusion-Exclusion, Generalization of the principles of Inclusion-Exclusion, Pigeon Hole Principle, Derangement, Generating function and introductory examples,	1
MM501: Complex analysis	Unit-1	5	Analytic Function: Limit, Continuity and differentiability, Analytic functions, Cauchy-Riemann equations. Necessary and sufficient condition for a function to be analytic, polar form of C.R. equation, Harmonic functions, Construction of analytic function.	1
	Unit-2	7	Complex Integrals : Definite integral, Jordan arc, contour, line integrals, Cauchy's theorem, simply and multiply connected domains, Cauchy's integral formula, Derivatives of analytic function, Morera's theorem, Liouville's theorem.	2
	Unit-3	3	Power series: Taylors's series, Laurent's series and their related problems.	1
	Unit-4	6	Poles & Residues: Definition and statement of the related theorems of isolated singularity, removable singularity and poles, calculation of residues, Cauchy's residue theorem.	2

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Paper Code/ Title	Allotted Unit	No. of Class Required	Details of the topics to be taught	No. of Tutorials
C3: Real Analysis	Unit-2	25	Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences. Cauchy sequence, Cauchy's Convergence Criterion.	10
C4: Differential Equation	Unit-2	8	Introduction to compartmental model, exponential decay model, lake pollution model (case study of Lake Burley Griffin), drug assimilation into the blood (case of a single cold pill, case of a course of cold pills), exponential growth of population, limited growth of population, limited growth with harvesting.	2
GE-2: Differential Equation	Unit-4	16	Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.	4

C10: Ring Theory and Linear Algebra I	Unit-1	14	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, operations on ideals, prime and maximal ideals.	6
	Unit-2	16	Ring homomorphisms, properties of ring homomorphisms, Isomorphism theorems I, II and III, field of quotients.	4
GE-4: Algebra	Unit-3	25	Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, \mathbb{Z} the ring of integers modulo n , ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions. Subrings and ideals, Integral domains and fields, examples of fields: \mathbb{Z}_p , \mathbb{Q} , \mathbb{R} , and \mathbb{C} . Field of rational functions.	5
MM602: Discrete Mathematics	Unit-1	4	Recurrence Relations: Formulation as Recurrence Relations, Solutions of Recurrence Relations, Solutions of homogeneous and non homogeneous linear Recurrence Relations, Generating Functions.	3
	Unit-2	5	Lattice: Definition and examples, Hasse diagram, Properties of Lattice, Lattice as an Algebraic systems, Sub lattice and lattice isomorphism, Special Classes: of lattice, Distributive lattice and Boolean algebras.	2
	Unit-3	6	Boolean Algebra: Boolean algebra as lattice and an algebraic system, Properties of Boolean algebra, Sub-algebra and homomorphism of Boolean algebra, Boolean expressions, sum-of-products canonical form, values of Boolean expression & Boolean functions, representation by Karnaugh Maps, minimization of Boolean functions using Karnaugh Maps.	2
	Unit-4	5	Logic Gates, Switching circuits & Logic circuits: Introduction, Gates and Boolean algebra, Applications, Special Sequences, Switching circuits, simplification of circuits, bridge circuits, logic circuits, multiple output logic circuit, minimization	2
MM602: Graph Theory	Unit-1	10	Graph Theory: Definition, Directed and undirected graphs, basic terminologies, finite and infinite graph, incidence and degree of vertex, isolated and pendent vertices, null graph, Handshaking theorem, types of graphs, sub graphs, graphs isomorphism, operations of graphs, connected graph, disconnected graphs and components.	2
	Unit-2	7	Walk, path and circuits, Eulerian graphs, Hamiltonian graphs, Dirac's theorem, Ore's theorem, Konigsberg's Bridge problem, Representation of graphs, matrix representation of graph, adjacency matrix, Incidence matrix, Linked representation of graph	2



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TEACHING PLAN

Course: B.A./ BSc.

Session: Even semester 2021 (January-June)

Subject: MATHEMATICS

Name of the Teacher: Ms. Sujata Goala

Methods to be applied: Lecture, activity method, interaction, and discussion.

Teaching Materials: White Board, Marker Pen, Duster, Books, Journals, Laptop, Projector

Paper Code/Title	Allotted Unit/ Topic	No. of Class Required	Detail of the topics to be taught	No. of tutorials
C3: Real Analysis	Unit-1	30	Review of Algebraic and Order Properties of \mathbb{R} , - neighborhood 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, The Completeness Property of \mathbb{R} , The Archimedean Property, Density of Rational (and Irrational) numbers in \mathbb{R} , Intervals. Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets.	5
C9: Riemann Integration and Series of Functions	Unit-4	21	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.	4
	Unit-5	17	Limit superior and Limit inferior. Power series, radius of convergence, Cauchy Hadamard Theorem, Differentiation and integration of power series; Abel's Theorem; Weierstrass Approximation Theorem.	3
C10: Ring Theory and Linear Algebra I	Unit-3	16	Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.	4
	Unit-4	25	Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms, Isomorphism	5

			theorems, invertibility and isomorphisms, change of coordinate matrix.	
MM601: Metric Space	Unit-1	7	Definition and examples of metric spaces, Open spheres and closed spheres, Neighborhoods, Open sets, Equivalent metrics, Interior points, Closed sets, Limit points and isolated points, Closure of a set, Boundary points, Distance between sets and diameter of a set, Subspace of metric space, Product metric spaces (definition only), Bases.	2
	Unit-2	5	Convergent sequences, Cauchy sequences, complete & separable spaces, dense sets.	1
	Unit-3	4	Continuous functions: Definition and characterizations, Extension theorem, Uniform continuity (definition only), Homeomorphism.	2
	Unit-4	3	Compact spaces and compact sets, Sequential compactness	1
MM601: Statistics	Unit-1	5	Probability: Basic terminology, Mathematical probability, Statistical probability, Axiomatic approach to probability. Some theorems on probability, Conditional probability, Multiplication theorem of probability, Independent events, Multiplication theorem of probability for independent events, Extension of multiplication theorem of probability, Baye's theorem.	2
	Unit-2	2	Measures of Dispersion: Standard deviation, Quartile deviation, co-efficient of variation.	1
	Unit-3	3	Correlation and regression: Karl Pearson's co-efficient of correlation, Spearman Rank correlation co-efficient, regression lines and equation.	1
	Unit-4	5	Theoretical Probability Distribution: Binomial, Poisson and Normal Distribution and their applications to simple problems.	2
	Unit-5	3	Time series analysis: Different components of time series, analysis of trends (Least Square Method and Moving Average Method)	1


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