JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-I (Honours) (CBCS)

Name of Faculty Members	Topic (From 15th July 2019 to 27th September 2019)		Topic (From 7st November 2019 to 12th December 2019)
Dr. S. Manna Associate Professor Head Of The Department	**C1 (H) Unit-IV: Differential Equation** Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors.	**PUJA VACATION PU**	**C1 (H) Unit-IV: Differential Equation** Separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.
	GE-1 Unit-IV: Differential Equation Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation. Exact differential equations and integrating factors.		**GE-1Unit-IV: Differential Equation** Separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations.
Sri. S. Sarkar Assistant Professor	**C1(H) Unit-I: Calculus** Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, envelopes, asymptotes.		**C1(H) Unit-I: Calculus** Curve tracing in cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.
	C2(H) Unit-I: Algebra Polar representation of complex numbers, nth roots of unity, De Moivre's theorem for rational indices and its applications. Theory of equations: Relation between roots and coefficients, transformation of equation.		**C2(H) Unit-I**: **Algebra** Theory of equations: Descartes rule of signs, cubic and biquadratic equation. Inequality: The inequality involving AM≥ GM≥ HM, Cauchy-Schwartz inequality.
	GE-I Unit-I: Calculus Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type $e^{ax+b}\sin x$, $e^{ax+b}\cos x$, $(ax+b)^n\sin x$, $(ax+b)^n\cos x$, concavity and inflection points, envelopes, asymptotes.		**GE-I Unit-I**: **Calculus** Curve tracing in cartesian coordinates, tracing in polar coordinates of standard curves, L'Hospital's rule, applications in business, economics and life sciences.
	C1(H) Unit-II: Calculus Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx\,dx$, $\int \cos nx\,dx$, $\int \tan nx\,dx$, $\int \sec nx\,dx$, $\int (\log x)^n\,dx$, $\int \sin^n x \sin^m x\,dx$, parametric equations, parameterizing a curve.		**C1(H) Unit-II: Calculus** Arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution, techniques of sketching conics.

Sri. A. De Assistant Professor	**C2(H) Unit-III: Algebra** 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. **C2(H) Unit-IV: Algebra** Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices.	**J A V A C A T I O N**	**C2(H) Unit- IV**: **Algebra** 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.
	GE-1 Unit-III: Geometry Reflection properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics. Spheres. Cylindrical surfaces. Central conicoids, paraboloids,		**GE-1 Unit-III**: **Geometry** Plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.
Sri. S. Roy Assistant Professor	**C1(H) Unit-III**: **Geometry** Reflection properties of conics, rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics. Spheres. Cylindrical surfaces. Central conicoids, paraboloids.		**C1(H) Unit-III: Geometry** Plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.
	C2(H) Unit-II: Algebra 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.		**C2(H) Unit-II: Algebra** Congruence relation between integers. Principles of Mathematical induction, statement of Fundamental Theorem of Arithmetic.
	GE-I Unit-II: Calculus Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx\, dx$, $\int \cos nx\, dx$, $\int \tan nx\, dx$, $\int \sec nx\, dx$, $\int (\log x)^n\, dx$, $\int \sin^n x \sin^m x\, dx$, parametric equations, parameterizing a curve.		**GE-I Unit-II**: **Calculus** Arc length of a curve, arc length of parametric curves, area under a curve, area and volume of surface of revolution, techniques of sketching conics.
	1st Internal Assessment: **2nd week of September 2019** **PTM-3rd Week of September**		**2nd Internal Assessment:** **Last week of November 2019** **Students' Seminar-3rd Week of November**

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-II(Honours) (CBCS)

Name of the Faculty Members	Topics: From 2nd January 2019 to 6th May 2020
Dr. S. Manna **Associate Professor** **Head of The Department**	**C4(H) Unit-IV**: **Vector Calculus** Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions.
Sri. S. Sarkar **Assistant Professor**	**C3(H) Unit-I: Real Analysis** Review of algebraic and order properties of R, ε-neighborhood of a point in R. Idea of countable sets, uncountable sets and uncountability of R. Bounded above sets, bounded below sets, bounded sets, unbounded sets. Suprema and infima. Completeness property of R and its equivalent properties. The Archimedean property, density of rational (and Irrational) numbers in 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 R, Heine-Borel Theorem.
	GE-2 Unit-III: Algebra 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.
Sri. A. De **Assistant professor**	**C3(H) Unit-II: Real Analysis** Sequences, bounded sequence, convergent sequence, limit of a sequence, liminf, lim sup. 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. **C3(H) Unit-III: Real Analysis** 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. Alternating series, Leibniz test. Absolute and conditional convergence.
	GE-2 Unit-I : **Algebra** Polar representation of complex numbers, nth 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 equation.

	Inequality: The inequality involving AM≥ GM≥ HM, Cauchy-Schwartz inequality. **GE-2 Unit-IV**: **Algebra** Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. 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.
Sri. S. Roy **Assistant Professor**	**C4(H) Unit-I: Differential Equations** Lipschitz condition and Picard's Theorem (Statement only). 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. **C4(H) Unit-II: Differential Equations** 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. **C4(H) Unit-III**: **Differential Equations** Equilibrium points, Interpretation of the phase plane Power series solution of a differential equation about an ordinary point, solution about a regular singular point.
	GE-2 Unit-II: Algebra 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.
	1st Internal Assessment: 2nd Week of March 2020 **2nd Internal Assessment: Last Week of April 2020** **Students' Seminar-3rd Week of March**

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-III(Honours) (CBCS)

Name of Faculty Members	Topic (From 10th July 2019 to 27th October 2018)		Topic (From 7th November 2019 to 12th December 2019)
Dr. S. Manna **Associate Professor** **Head Of The Department**	**SEC-1(H): Logic and Sets:-** **Unit1** 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.	**PUJA VACATION**	**SEC-1(H): Logic and Sets:-** **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.
Sri. S. Sarkar **Assistant Professor**	C7**(H)**: **Numerical Methods:-** **Unit 1** Algorithms. Convergence. Errors: relative, absolute. Round off. Truncation. **Unit 2** 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. **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 interpolation. Numerical differentiation: Methods based on interpolations, methods based on finite differences.		C7**(H)**: **Numerical Methods:-** **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 eigen value problem: Power method. Approximation: Least square polynomial approximation. **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.

Sri. A. De **Assistant Professor**	**C6(H): Group Theory :-** **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 theorem.	**P U J A** **V A C A T I O N**	**C6(H): Group Theory :-** **Unit 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.
Sri. S. Roy **Assistant Professor**	**C5(H)**:**Theory of Real Functions** :- **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, uniform continuity theorem. **Unit 2** 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. **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.		**C5(H): Theory of Real Functions** :- **Unit 3** Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions, ln (1 + x), 1/(ax + b) and(x+1)n. Application of Taylor's theorem to inequalities. **Introduction to Metric Space:-** **Unit 4** Metric spaces: Definition and examples. open and closed balls, neighborhood, open set, interior of a set. Limit point of a set, closed set, diameter of a set, subspaces, dense sets, separable spaces.
	1st Internal Assessment: **2nd week of September 2019** **PTM-3rd Week of September**		**2nd Internal Assessment:** **Last week of November 2019** **Students' Seminar-3rd Week of November**

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-IV(Honours) (CBCS)

Name of the Faculty Members	Topics (From 2nd January 2020 to 6th May 2020)
Dr. S. Manna **Associate Professor** **Head of The Department**	**SEC-2(H): Graph Theory** **Unit 1** Definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bipartite graphs isomorphism of graphs. **Unit 2** Eulerian circuits, Eulerian graph, semi-Eulerian graph, theorems, Hamiltonian cycles,theorems Representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph, **Unit 3** Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.
Sri. S. Sarkar **Assistant Professor**	**C8(H):Riemann Integration and Series of Function** **Unit 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. 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. **Unit 2** Improper integrals. Convergence of Beta and Gamma functions. **Unit 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. **Unit 4** Fourier series: Definition of Fourier coefficients and series, Reimann Lebesgue lemma, Bessel's inequality, Parseval's identity, Dirichlet's condition. Examples of Fourier expansions and summation results for series. **Unit 5** Power series, radius of convergence, Cauchy Hadamard theorem. Differentiation and integration of power series; Abel's theorem; Weierstrass approximation theorem.

Sri. A. De **Assistant professor**	**C10(H): Ring Theory and Linear Algebra I** **Unit 1** 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. **Unit 2** Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III, field of quotients. **Unit 3** Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces. **Unit 4** Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations. Isomorphisms. Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.
Sri. S. Roy **Assistant Professor**	**C9(H): Multivariate Calculus** **Unit 1** Functions of several variables, limit and continuity of functions of two or more variables Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability. Chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems **Unit 2** Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates, 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. **Unit 3** Definition of vector field, divergence and curl. Line integrals, applications of line integrals: mass and work. Fundamental theorem for line integrals, conservative vector fields, independence of path. **Unit 4** Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.
	1st Internal Assessment: 2nd Week of March 2020 **2nd Internal Assessment: Last Week of April 2020** **Students' Seminar-3rd Week of March**

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-V(Honours) (CBCS)

Name of Faculty Members	Topic (From 10th July 2019 to 27th October 2018)		Topic (From 7th November 2019 to 12th December 2019)
Dr. S. Manna **Associate Professor** **Head Of The Department**	**DSE-1(H): 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. 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.	**PUJA VACATION**	**DSE-1(H): Linear Programming** **Unit 3** Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure,linearprogramming solutionof games.
Sri. S. Sarkar **Assistant Professor**	**DSE-2(H): 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 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.		**DSE-2(H): Probability and Statistics** **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. **Unit 4** Random Samples, Sampling Diatributions, Estimation of parameters, Testing of hypothesis.

Sri. A. De **Assistant Professor**	**C12(H): Group Theory II** **Unit 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. **Unit 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. **Unit 3** Group actions, stabilizers and kernels, permutation representation associated with a given group action. Applications of group actions. Generalized Cayley's theorem. Index theorem.	**PUJA VACATION**	**C12(H): Group Theory II** **Unit 4** Groups acting on themselves by conjugation, class equation and consequences, conjugacy in Sn, p-groups, Sylow's theorems and consequences, Cauchy's theorem, Simplicity of An for n ≥ 5, non-simplicity tests.
Sri. S. Roy **Assistant Professor**	**C11(H)**: **Partial Differential Equations & 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 or elliptic. Reduction of second order linear equations to canonical forms. **Unit 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.		**C11(H): Partial Differential Equations & Applications** **Unit 3** Method of separation of variables, solving the vibrating string problem. Solving the heat conduction problem **Unit 4** Central force. Constrained motion, varying mass, tangent and normal components of acceleration, modelling ballistics and planetary motion, Kepler's second law.
	1st Internal Assessment: **2nd week of September 2019** **PTM- 3rd Week of September**		**2nd Internal Assessment:** **Last week of November 2019** **Students' Seminar-3rd Week of November**

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-VI(Honours) (CBCS)

Name of the Faculty Members	Topics (From 2nd January 2020 to 6th May 2020)
Sri. S. Sarkar **Assistant Professor**	**C13(H): Metric Spaces** **Unit 1** Metric spaces: sequences in metric spaces, Cauchy sequences. Complete metric spaces, Cantor's theorem. **Unit 2** Continuous mappings, sequential criterion and other characterizations of continuity. Uniform continuity. Connectedness, connected subsets of R. Compactness: Sequential compactness, Heine-Borel property, totally bounded spaces, finite intersection property, and continuous functions on compact sets. Homeomorphism. Contraction mappings. Banach fixed point theorem and its application to ordinary differential equation. **Unit 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.
	DSE-4: Mathematical Modelling **Unit 1** Power series solution of Bessel's equation and Legendre's equation, Laplace transform and inverse transform, application to initial value problem up to second order. **Unit 2** Monte Carlo simulation modelling: simulating deterministic behavior (area under a curve, volume under a surface), generating random numbers: middle square method, linear congruence, queuing models: harbor system, morning rush hour, Overview of optimization modelling. Linear programming model: geometric solution algebraic solution, simplex method, sensitivity analysis

Sri. A. De **Assistant professor**	**C14(H): Ring Theory and Linear Algebra II** **Unit 1** 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 Z [x]. Divisibility in integral domains, irreducible, primes, unique factorization domains, Euclidean domains. **Unit 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, diagonalizability, invariant subspaces and Cayley-Hamilton theorem, the minimal polynomial for a linear operator, canonical forms. **Unit 3** Inner product spaces and norms, Gram-Schmidt orthogonalisation process, orthogonal complements, Bessel's inequality, the adjoint of a linear operator. Least squares approximation, minimal solutions to systems of linear equations. Normal and self-adjoint operators. Orthogonal projections and Spectral theorem.
Sri. S. Roy **Assistant Professor**	**C13(H):Complex Analysis** **Unit 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. **Unit 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. **Unit 5** Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples. **Unit 6** Laurent series and its examples, absolute and uniform convergence of power series.

	DSE-3(H): Number Theory **Unit 1** Linear diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linearcongruences, complete set of residues. Chinese remainder theorem, Fermat's little theorem, Wilson's theorem. **Unit 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. **Unit 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 x2 + y2= z2, Fermat's Last theorem.
	1st Internal Assessment: 2nd Week of March 2020 **2nd Internal Assessment: Last Week of April 2020** **Students' Seminar-Could not be performed due to COVID 19 Pandemic.**

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-I (Gneral) (CBCS)

Name of Faculty Members	Topic (From 15th July 2019 to 27th September 2019)	PUJA VCATION	Topic (From 7th November 2019 to 12th December 2019)
Sri. A. De Assistant Professor	**DSC-1A(CC-1): Differential Calculus** 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.		**DSC-1A(CC-1): Differentia Calculus** Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves.
Sri. S. Roy Assistant Professor	**DSC-1A(CC-1):Differential Calculus** Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates. Rolle's theorem, Mean Value theorems, Lagrange and cauchy theorems. Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Power series and its convergences.		**DSC-1A(CC-1)Differential Calculus** Taylor's series, Maclaurin's series of sin x, cos x, ex, log(l+x), (l+x)m, Maxima and Minima, Indeterminate forms.
			Internal Assessment: Last week of November 2019

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-II(General) (CBCS)

Name of the Faculty Members	Topics (From 2nd January 2019 to 6th May 2020)
Sri. A. De **Assistant professor**	**DSC-1B(CC-2): Differential Equations** First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order. 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.
Sri. S. Roy **Assistant Professor**	**DSC-1B(CC-2): Differential Equations** 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. Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.
Internal Assessment: 2nd Week of April 2020	

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-III (Gneral) (CBCS)

Name of Faculty Members	Topic (From 10th July 2019 to 27th September 2019)	PUJAVCATION	Topic (From 7th November 2019 to 12th December 2019)
Sri. S. Sarkar **Assistant professor**	**DSC-1C(G): Real Analysis** Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem. 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). 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).		**DSC-1C(G): Real Analysis** Definition and examples of absolute and conditional Convergence Series. Sequences and series of functions, Pointwise and uniform convergence. μ-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.
Sri. A. De **Assistant Professor**	**SEC-I(G):Theory of Equations** General properties of polynomials, Graphical representation of polynomials, maximum and minimum values of a polynomial, General properties of equations, Descarte's rule of signs positive and negative rule, Relation between the roots and the coefficients of equations. Symmetric functions, Applications of symmetric function of the roots.		**SEC-I(G): Theory of Equations** Transformation of equations. Solutions of reciprocal and binomial equations. Algebraic solutions of the cubic and biquadratic equations. Properties of the derived functions.
			Internal Assessment: **Last week of November 2019**

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Semester-IV(General) (CBCS)

Name of the Faculty Members	Topics (From 2nd January 2019 to 6th May 2020)
Dr. S. Manna **Associate Professor** **Head Of The Department**	**SEC-2(G): Integral Calculus** 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. Evaluation of areas and lengths of curves in the plane, valuation of volumes and surfaces of solids of revolution. Double and Triple integrals.
Sri. A. De **Assistant professor**	**DSC-1(D):Algebra** Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn 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 GLn (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. Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups. Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn 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: Zp, Q, R, and C. Field of rational functions.
Internal Assessment: 2nd Week of April 2020	

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2019-2020
B.Sc. Part-III (General)

Name of Faculty Member	Topic(From 10th July 2019 to 27th September 2019)		Topic(From 7th November 2019 to 28th March 2020)
Sri. S. Sarkar **Assistant Professor**	**Paper-IV, Group-A: Elements of Computer Science:-** Computers and their functions and programming: Computers and their function: Information processing. History of data processing machines. Digital Computer, components and their functions and interactions input: storage, control, arithmetic logic and output systems, analogy between the working of a clerk and computer, analog and digital computers. Punched cards and different input / output media applications computers. Elementary Computers Programming: Concepts of machine language, assembly language, different higher level languages and compilers, Fixed and floating point models, constants and variables, subscripted variables, arithmetic expression, Library functions, FORTRAN - 77 : Statements, arithmetic, input, output and control statements. Arithmetic assignment statement, GO TO, Arithmetic IF, Logical IF, BLOCK IF, DO, CONTINUE, READ, WRITE, PRINT, STOP, END, DIMENSION and FORMAT (List directed, I, E, F, X ,and H specification only). Two dimensional arrays, Date cards.	**PUJA VCATION** **PU**	**Paper-IV, Group-A: : Elements of Computer Science:-** Applications of computer programming: Different steps of solving a problem by a computer. Computer oriented algorithm. Flow-chart. Writing on a coding sheet and computer programmes in FORTRAN for the solution of simple computational problems including problems: Evaluation of functions, Solutions of quadratic equation, Determination of the approximate sum of convergent infinite series sorting. Finite set of numbers in ascending and descending order, Solution of equations by iteration and Newton-Raphson method, Numerical integration by Simpson's one third rule. **Boolean Algebra and Applications**: Binary arithmetic-binary numbers, binary-to-decimal conversion, Decimal-to-binary conversion. Addition, Subtraction, Multiplication and Division of binary numbers. Definition of Boolean algebra by Huntington postulates. Two element Boolean algebra and other examples. Principle of Duality. Basic theorems, Boolean functions. Truth table, Disjunctive and conjunctive normal forms. Theorems on construction of a Boolean function from a truth table and examples. Different binary operations and operators. AND, OR, NOT, NAND, NOR. Bistable devices, Logic Gates-AND, OR, NOT, NAND, NOR (including block diagram and input-output table). Logic Gates representations for Boolean expressions.

Sri. A. De **Assistant Professor**	**Paper-I, Group-B: Elements of Probability Theory:** Random experiments, Statistical regularity and idea of probability as long run mutually exclusive event and exhaustive events, union, Intersection and complement, classical definition of probability, axiomatic approach of probability theory (detailed treatment not required), theorem on the union of a number of events, conditional probability, theorem of total probability and Bayes' theorem, independent event and independent trials, random variable and its probability distribution, expectation and variance. Joint, marginal and conditional distribution.	**JA VACATION**	**Paper-I, Group-B: Elements of Statistics:** Qualitative and quantitative characters. Discrete variable and continuous variable, frequency distribution and its graphical representation, measures of central tendency (mean median and mode), measures of dispersion (range, mean deviation and standard deviation), Skewness and Kurtosis, moments and β_1 and β_2 coefficients. Binomial, Poisson and normal distribution. Correlation and regression. Estimation of parameters, maximum likelihood method, interval estimation.
	1st Internal Assessment: **2nd week of September 2019**		**2nd Internal Assessment:** **2nd week of March 2020**