

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Semester-I (Honours) (CBCS)

Name of Faculty Members	Topic (From 15 th July 2018 to 6 th October 2018)	P U J A V A C A T I O N P U	Topic (From 26 th November 2018 to 12 th December 2018)
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.		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-1 Unit-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 $AM \geq GM \geq HM$, 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 $\int \sin nx \, dx$, $\int \cos nx \, dx$, $\int \tan nx \, dx$, $\int \sec nx \, dx$, $\int (\log x)^n \, dx$, $\int \sin^n x \cos^m x \, dx$, 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	<p>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.</p> <p>C2(H) Unit-IV: Algebra Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices.</p>	J A V A C A T I O N	<p>C2(H) Unit- IV: Algebra Subspaces of R^n, dimension of subspaces of R^n, 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.</p>
	<p>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,</p>		<p>GE-1 Unit-III: Geometry Plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.</p>
Sri. S. Roy Assistant Professor	<p>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.</p>		<p>C1(H) Unit-III: Geometry Plane sections of conicoids, generating lines, classification of quadrics, illustrations of graphing standard quadric surfaces like cone, ellipsoid.</p>
	<p>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.</p>		<p>C2(H) Unit-II: Algebra Congruence relation between integers. Principles of Mathematical induction, statement of Fundamental Theorem of Arithmetic.</p>
	<p>GE-I Unit-II: Calculus Reduction formulae, derivations and illustrations of reduction formulae of the type $\int \sin nx \, dx$, $\int \cos nx \, dx$, $\int \tan nx \, dx$, $\int \sec nx \, dx$, $\int (\log x)^n \, dx$, $\int \sin^n x \cos^m x \, dx$, parametric equations, parameterizing a curve.</p>		<p>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.</p>
	<p>1st Internal Assessment: 2nd week of September 2018 PTM-3rd Week of September</p>		<p>2nd Internal Assessment: 1st week of December 2018 Students' Seminar-3rd Week of November</p>

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Semester-II(Honours) (CBCS)

Name of the Faculty Members	Topics: From 2 nd January 2019 to 6 th May 2019
<p style="text-align: center;">Dr. S. Manna Associate Professor Head of The Department</p>	<p>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.</p>
<p style="text-align: center;">Sri. S. Sarkar Assistant Professor</p>	<p>C3(H) Unit-I: Real Analysis Review of algebraic and order properties of \mathbb{R}, ε-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. Completeness property of \mathbb{R} and its equivalent properties. 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.</p>
	<p>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.</p>
<p style="text-align: center;">Sri. A. De Assistant professor</p>	<p>C3(H) Unit-II: Real Analysis Sequences, bounded sequence, convergent sequence, limit of a sequence, \liminf, \limsup. 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.</p> <p>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.</p>
	<p>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.</p>

	<p>Inequality: The inequality involving $AM \geq GM \geq HM$, Cauchy-Schwartz inequality.</p> <p>GE-2 Unit-IV: Algebra</p> <p>Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Subspaces of R^n, dimension of subspaces of R^n, 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.</p>
<p style="text-align: center;">Sri. S. Roy Assistant Professor</p>	<p>C4(H) Unit-I: Differential Equations</p> <p>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.</p> <p>C4(H) Unit-II: Differential Equations</p> <p>Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients,</p> <p>Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions.</p> <p>C4(H) Unit-III: Differential Equations</p> <p>Equilibrium points, Interpretation of the phase plane Power series solution of a differential equation about an ordinary point, solution about a regular singular point.</p>
	<p>GE-2 Unit-II: Algebra</p> <p>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.</p>
	<p>1st Internal Assessment: 2nd Week of March 2019 2nd Internal Assessment: Last Week of April 2019 Students' Seminar-3rd Week of March</p>

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Semester-III(Honours) (CBCS)

Name of Faculty Members	Topic (From 10 th July 2018 to 6 th October 2018)	P U J A V A C A T I O N	Topic (From 26 th November 2018 to 12 th December 2018)
Dr. S. Manna Associate Professor Head Of The Department	<p>SEC-1(H): Logic and Sets:-</p> <p>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.</p> <p>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.</p>		<p>SEC-1(H): Logic and Sets:-</p> <p>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.</p>
Sri. S. Sarkar Assistant Professor	<p>C7(H): Numerical Methods:-</p> <p>Unit 1 Algorithms. Convergence. Errors: relative, absolute. Round off. Truncation.</p> <p>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.</p> <p>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.</p> <p>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.</p>		<p>C7(H): Numerical Methods:-</p> <p>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.</p> <p>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.</p>

<p style="text-align: center;">Sri. A. De Assistant Professor</p>	<p>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>	P U J A V A C A T I O N	<p>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.</p>
<p style="text-align: center;">Sri. S. Roy Assistant Professor</p>	<p>C5(H): Theory of Real Functions :- Unit 1 Limits of functions ($\epsilon - \delta$ approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity. Continuous functions, 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.</p>		<p>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.</p>
	<p>1st Internal Assessment: 2nd week of September 2018 PTM-3rd Week of September</p>		<p>2nd Internal Assessment: 1st week of December 2018 Students' Seminar-3rd Week of November</p>

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Semester-IV(Honours) (CBCS)

Name of the Faculty Members	Topics (From 2 nd January 2019 to 6 th May 2019)
<p style="text-align: center;">Dr. S. Manna Associate Professor Head of The Department</p>	<p>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.</p>
<p style="text-align: center;">Sri. S. Sarkar Assistant Professor</p>	<p>C8(H):Riemann Integration and Series of Function Unit 1 Riemann integration: inequalities of upper and lower sums, Darboux integration, Darboux 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, Riemann 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.</p>

<p style="text-align: center;">Sri. A. De Assistant professor</p>	<p>C10(H): Ring Theory and Linear Algebra I</p> <p>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.</p> <p>Unit 2 Ring homomorphisms, properties of ring homomorphisms. Isomorphism theorems I, II and III, field of quotients.</p> <p>Unit 3 Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.</p> <p>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.</p>
<p style="text-align: center;">Sri. S. Roy Assistant Professor</p>	<p>C9(H): Multivariate Calculus</p> <p>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</p> <p>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.</p> <p>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.</p> <p>Unit 4 Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.</p>
	<p>1st Internal Assessment: 2nd Week of March 2019 2nd Internal Assessment: Last Week of April 2019 Students' Seminar-3rd Week of March</p>

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Part-III (Honours)

Name of Faculty Members	Topic(From 10 th July 2018 to 6 th October 2018)	P U J A V A C A T I O N	Topic(From 26 th November 2018 to 28 th March 2019)
<p style="text-align: center;">Dr. S. Manna Associate Professor Head Of The Department</p>	<p>Paper-VI, Group-C: Discrete Mathematics :- Sets and Propositions: Cardinality, principle of inclusion and exclusion, connectives, Tautology and contradictions, equivalence formula.</p> <p>Graph Theory: Graphs: undirected graphs, Directed graphs, basic properties, complete graph, complement of a Graph.</p>		<p>Paper-VI, Group-C: Discrete Mathematics :- Bipartite Graphs, Necessary and Sufficient condition for a Bipartite Graph, Weighted Graphs, Walk, Path, Cycles, Circuit, Euler Graph, Konisberg Bridge Problem. Trees: Basic properties, spanning tree.</p> <p>Partial order relations and Lattices: Definitions of poset, lattice, chain and anti-chain, properties of a lattice, distributive lattice with properties.</p> <p>Discrete numeric functions and generating functions.</p>
	<p style="text-align: center;">Sri. S. Sarkar Assistant Professor</p>		<p>Paper-VI, Group-D: Mathematical Modeling:- Introduction, Basic steps of Mathematical modeling and its utility, preliminary concept of stability of differential equation.</p>
<p>Paper-VII, Group-A: Elements of computer Science:- Elementary computers programming: Concepts of machine language, assembly language, different high level languages and compilers. Application of computer programming: Different steps of solving a problem by a Computer. Computer oriented algorithm. Flowchart.</p> <p>Boolean Algebra and applications:- Binary arithmetic: binary numbers, binary-to-decimal conversion, decimal-to- binary conversion, Addition, subtraction, multiplication and division of binary numbers, Algebra of sets. Definition of</p>			<p>Paper-VII, Group-A: Programming Languages: Either FORTRAN 77 or ANSI C</p> <p>FORTRAN 77: Fixed and floating point modes, constants and variables, subscripted variables, arithmetic expression, library functions, statements, and 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, arithmetic statement, functions subprogram, subroutine subprogram. strings.</p> <p>ANSI C: Character set in ANSI C. Key words: if, while, do, for, int, char, float, etc. Data type: character, integer, floating point,</p>

	<p>Boolean algebra by Huntington postulates, Two elements Boolean algebra and other examples, principle of duality, basic theorems, Boolean functions, truth table, disjunctive and conjunctive normal forms, Theorem 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, Binary half adder and full adder.</p>	<p>P U J A</p>	<p>etc. Variables, Operators: \square, $\square\square$, $!$, $<$, $>$, etc. (arithmetic, assignment, relational, logical, increment, etc.). Expressions: arithmetic and logical expressions. Standard input/output. Use of while, if-else, for, do - while, switch, continue, etc. Arrays, strings, user defined function. Header File. The various problems on Mathematics are to be studied during programming in FORTRAN 77 or in C:</p>
	<p>Paper-VIII, Group-D: Computer Practical:- List of programs using FORTRAN or C</p> <p>General programs Area of circle, triangle, (ii) Summation of finite and convergent infinite series, (iii) Maximum and minimum among three number and n numbers, (iv) Roots of a quadratic equation, (v) G.C.D. and L.C.M. between two integers, (vi) Testing of prime numbers, (vii) Split a number into digits, (viii) Computation of ${}^n P_r$ and ${}^n C_r$, (viii) Searching and sorting (bubble sort only). Problems on matrices Addition and subtraction, (ii) Product, (iii) Trace and (iv) Transpose.</p>	<p>V A C A T I O N</p>	<p>Paper-VIII, Group-D: : Computer Practical:- List of programs using FORTRAN or C Problems on strings (i)Counting of words in a string, (ii) Palindrome testing, (iii) Conversion from upper case to lower case and lower case to upper case, (iv) Sorting of names, (v) Rewrite name of a person in short form, (vi) searching a sub-string among a set of strings. Problems on Numerical Methods (i)Interpolation by Lagrange's and Newton forwards difference methods, (ii) Finding of roots by bisection, regula-falsi, fixed point iteration and Newton- Rapshon methods, (iii) Integration by trapezoidal and Simpson 1/3 rule, (iv) Solution of a system of equations by Gauss-Siedal method, (v) Solution of a differential equation by Runge-Kutta methods. Problems on Statistical methods (i)Preparation of grouped frequency table, (ii) Mean, median and mode for simple and grouped frequency distribution, (iii) Standard deviation, mean deviation, (iv) Moments, skewness and kurtosis, (v) Correlation and regression, (vi) Fitting of straight and parabolic curve.</p>
	<p>Paper-VII, Group B: Mathematical Theory of Probability:- Concepts of mathematical probability, Random experiments, The idea of probability as a long run relative frequency. Sample space, mutually exclusive</p>		<p>Paper-VII, Group-B: Mathematical Theory of Probability:- Discrete and continuous distributions, probability distribution function, expectation, variance, moments of a random variable, basic ideas of moment generating function (m.g.f.) and characteristic function, dependent and</p>

<p style="text-align: center;">Sri. Abhoy De Assistant Professor</p>	<p>events, exhaustive events. Union of events, intersection of events, Kolmogorov's axiomatic definition of probability, classical definition as a special case of the axiomatic, theorems on the probability of the union of an events. Theorem of total probability, Boole's inequality, conditional probability, theorem of compound probability, theorem of inverse probability (Baye's theorem). Statistical independence of events, independent trials, random variables.</p>	<p style="text-align: center;">P U J A</p> <p>independent trials. Bernoulli's trials, Binomial law, Joint distribution of two random variables and transformation of variables. Marginal and conditional distributions, Sum law and product law of expectation, two dimensional expectation and conditional expectation, Correlation and regression. Tchebycheff's inequality, convergence in probability, Bernoulli's limit theorem, weak law of large numbers. Central limit theorem (statement only). Poissons approximation to Binomial distribution, Normal approximation to Binomial distribution. Detailed understanding of hyper-geometric binomial, negative binomial and Poisson distributions and (b) rectangular, gamma, beta and normal distributions, χ^2 and t distributions.</p>
	<p>Paper-VII, Group-C: Mathematical Statistics:- Collection of data, Tabulation and graphical representation of data, Qualitative and quantitative characteristics of discrete and continuous variables, Frequency table and its graphical representation. Measures of central tendency: mean (simple and weighted), median mode. Measures of dispersion: range, mean deviation and standard deviation, coefficient of variation, moments, skewness and kurtosis.</p>	<p style="text-align: center;">V A C A T I O N</p> <p>Paper-VII, Group-C: Mathematical Statistics:- Random sampling, sampling distribution of a statistic. Sampling distribution of a sample means (normal population case) and sample proportion. Statistical inference. Point estimation of a parameter unbiased and consistent estimates. Method of maximum likelihood. Bivariate data, Scattered diagram, simple correlation and regression, curve fitting (linear and parabolic). Statistical hypothesis: Simple and composite, critical region of a test. Type-I and Type- II error. Confidence interval and confidence coefficients: Confidence interval for a single variance (normal distribution), Neyman-Pearson theorem (statement only). Testing of Hypothesis (large and small sample, Normal distribution only).</p>
	<p>Paper-VIII, Group-A: Numerical Analysis:-Basic concepts: approximation of numbers, significant figures, absolute, relative and percentage errors, truncation and round off errors, accumulation and propagation of errors.</p> <p>Polynomial interpolation and application: Lagrangian interpolation problem. Linear interpolation formula. Lagrange's</p>	<p style="text-align: center;">P U</p> <p>Paper-VIII, Group-A: Numerical Analysis:-Numerical integration: Newton's Cotes formulae, trapezoidal rule, Simpson's one- third rule and inherent errors, Weddle's rule, Summation of finite series by Euler- Maclaurin series (statement only). Solution of equations (algebraic and transcendental) : Solution of a single equation by – Graphical method, Method of bisection,</p>

	<p>formula.</p> <p>Differences: Forward, backward and divided difference tables, linear difference equations with constant coefficients. Newton's general interpolation formula with remainder term, Newton's forward and backward formulae, error in these formulae. Numerical differentiation based on Newton's forward and backward formulae.</p>	<p>J A</p>	<p>Regula falsi method, Fixed point iteration method, Newton-Raphson method. Geometrical interpretation of these methods. Convergence of fixed-point iteration and Newton-Raphson method.</p> <p>Gauss-elimination, Gauss-Siedal method for the solution of a system of linear equations. Solution of differential equations: Solution of a first order differential equation by Euler's method and modified Euler's method. Runge-Kutta (2nd and 4th order) methods (emphasizing the problem only)</p>
<p>Sri. S. Roy Assistant Professor</p>	<p>Paper-VI, Group-A: Rigid Dynamics:- Moment and product of inertia, Momental ellipsoid, Equimomental system, Principal axis, D'Alembert's principle. D'Alembert's equations of motion. Principles of moments, Principles of conservations of linear and angular momentum. Independence of the motion of centre of inertia and the motion relative to the centre of inertia. Principle of energy. Principle of conservation of energy.</p> <p>Equation of motion of a rigid body about a fixed axis. Expression for kinetic energy and moment of momentum of a rigid body moving about a fixed axis. Compound pendulum. Interchangeability of the points of a suspension and centre of oscillation. Minimum time of oscillation. Reaction of axis of rotation.</p>	<p>V A C A T I O N</p>	<p>Paper-VI, Group-A: Rigid Dynamics:- Equations of motion of a rigid body moving in two dimensions. Expression for kinetic energy and angular momentum about the origin of a rigid body moving in two dimensions. Two dimensional motion of a solid of revolution down a rough inclined plane. Necessary and sufficient condition for pure rolling. Two dimensional motion of a solid of revolution moving on a rough horizontal plane.</p> <p>Equations of motion under impulsive forces. Equation of motion about a fixed axis under impulsive forces. Centre of percussion. To show that (i) if there is a definite straight line such that the sum of the moments of the external impulses acting on a system of particles about it vanishes, then the total angular momentum of the system about that line remains unaltered, (ii) the change of K.E. of a system of particles moving in any manner under the application of impulsive forces is equal to the work done by the impulsive forces. Impulsive forces applied to a rigid body moving in two dimensions.</p>
	<p>Paper-VI, Group-B: Hydrostatics:- Definition of Fluid, Perfect Fluid, Pressure. To prove that the pressure at a point in a fluid in equilibrium is the same in every direction. Transmissibility of liquid pressure. Pressure of heavy fluids. To prove – In a fluid at rest under gravity the pressure is the same at all points in</p>	<p>P U J A</p>	<p>Paper-VI, Group-B: Hydrostatics:- Equilibrium of fluids in given fields of force: Definition of field of force, line of force. Pressure derivative in terms of force. Surface of equi-pressure. To find the necessary and sufficient conditions of equilibrium of a fluid under the action of a force whose components are X, Y, Z along the co-ordinate axes. To prove (i) that surfaces of equal pressure are the surfaces</p>

<p>the same horizontal plane. In a homogeneous fluid at rest under gravity the difference between the pressures at two points is proportional to the difference of their depths. In a fluid at rest under gravity horizontal planes are surfaces of equal density. When two fluids of different densities at rest under gravity do not mix, their surface of separation is a horizontal plane. Pressure in heavy homogeneous liquid. Thrust of heavy homogeneous liquid of plane surfaces. Definition of centre of pressure. Formula for the depth of the centre of pressure of a plane area. Position of the centre of pressure. Centre of pressure of a triangular area whose angular points are at different depths. Centre of pressure of a circular area. Position of the centre of pressure referred to co-ordinate axes through the centroid of the area. Centre of pressure of an elliptical area when its major axis is vertical or along the line of greatest slope. Effect of additional depth on centre of pressure.</p>	<p>V A C A T I O N</p> <p>intersecting orthogonally the lines of force. (ii) when the force system is conservative, the surfaces of equal pressure are equipotential surfaces and are also surfaces of equal density. To find the differential equations of the surfaces of equal pressure and density. Rotating fluids. To determine the pressure at any point and the surfaces of equal pressure when a mass of homogeneous liquid contained in a vessel, revolves uniformly about a vertical axis. Thrust on Curved Surface. The stability of the equilibrium of floating bodies. Definition, stability of equilibrium of a floating body, metacentre, plane of floatation, surface of buoyancy. General propositions about small rotational displacements. To derive the condition for stability.</p>	<p>Paper-VIII, Group-B:Real Analysis-III:- Real Valued functions defined on a subset (may not be an interval) of real numbers; limit of a real-valued function at a limit point of the domain (subset of R) of the functions, sequential and Cauchy's criteria for the existence of a limit of a function at a point. Algebra of limits in this context. Continuity of a function at a point on a subset of R, Sequential criteria for continuity at a point, continuity on a set. Algebra of continuous functions as a consequence of algebra of limits, continuity of composites of continuous functions. Uniform continuity on a set. If f is continuous on a closed and bounded subset of R, then f is uniformly</p>	<p>Paper-VII, Group-B: Real Analysis-III:- Sequence of functions: Pointwise and uniform convergence, Cauchy's criteria for Uniform convergence, Weierstrass M-test, boundedness, continuity, differentiability and integrability of the limit function in case of uniform convergence. Series of functions: Pointwise and uniform convergence, Cauchy's criteria for uniform convergence, Boundedness and continuity of the sum function in case of uniform convergence. Term by term integration and differentiation. Weierstrass M- test for uniform and absolute convergence. Power series: Cauchy-Hadamard theorem, Radius of convergence, uniform convergence of power series and their related properties, uniqueness of a power series. Fourier series. Dirichlet's condition of</p>
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	<p>continuous there. If f is uniformly continuous on a subset of real numbers then it is uniformly continuous on the closure of S.</p>	<p>convergence at a point. Full range and half range series.</p>
	<p>Paper-VIII, Group-C: Linear Algebra-II:- Linear Transformation on Vector spaces: Definition, Null space, range space, rank and nullity, Sylvester's law.</p>	<p>Paper-VIII, Group-C: : Linear Algebra-II:- Linear Transformation on Vector spaces: Sylvester's law, simple applications, non-singular linear transformation inverse of linear transformation. An $(m \times n)$ real matrix as a linear transformation from R^n to R^m.</p>
	<p>1st Internal Assessment: 2nd week of September 2018 PTM-3rd Week of September</p>	<p>2nd Internal Assessment: 2nd week of March 2019 Students' Seminar-3rd Week of November</p>

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Semester-I (Gneral) (CBCS)

Name of Faculty Members	Topic (From 15 th July 2018 to 6 th October 2018)	P U J A V C A T I O N	Topic (From 26 th November 2018 to 12 th December 2018)
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 $\sin x$, $\cos x$, e^x , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.
			Internal Assessment: 1st week of December 2018

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Semester-II(General) (CBCS)

Name of the Faculty Members	Topics (From 2 nd January 2019 to 6 th May 2019)
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 2019	

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Part-II (General)

Name of Faculty Members	Topic (From 10 th July 2018 to 6 th October 2018)		Topic (From 26 th November 2018 to 26 th April 2019)
Dr. S. Manna Associate Professor Head Of The Department	<p>Paper-II, Group-A: Differential Calculus:-Concept of rational number, Irrational number, Real number. Sequence of numbers, concept of limit of a sequence, Null sequence, Bounded sequence, Monotonic sequence, supremum and infimum of a sequence; A convergent sequence is bounded and has a unique limit, Bounded and monotonic sequence is convergent.</p> $e = \lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$ <p>Statement of the theorems on limits of sequence, Cauchy sequence, Statement of Cauchy's general principle of convergence, simple problem. Infinite series of constant term: Definition of convergence and divergence, Cauchy's convergence Principle (application only), Geometric series and p-series and their convergence (Only statement). Series of non-negative terms: Statement of comparison test. D' Alembert ratio test, Cauchy's nth root test and Raabe's test. Simple applications.</p> <p>Function of a single real variable defined on an interval, their graphs, Algebra of limits and continuity (no proof). Definition and acquaintance (no proof required) with the properties of continuous function on closed intervals, statement and existence of inverse function of a strictly monotonic function and its continuity.</p> <p>Derivatives - its geometric and physical interpretation, rule of differentiation (a revision of previous knowledge only). Differential its geometrical interpretation and application in finding approximations, relation between continuity and derivability.</p>	P U J A V A C A T I O N	<p>Paper-II, Group-A: Differential Calculus:-Successive derivatives, Leibnitz theorem: increasing and decreasing functions, sign of the derivatives, statement of Rolle's Theorem and its geometrical interpretation. Mean value theorems of Lagrange's, its geometrical interpretation, Cauchy's mean value theorem. Taylor's and Maclaurin's theorems with Cauchy's and Lagrange's form of remainder (statement only). Expansion in power of x with infinite series for such functions as $exp(x)$, $sin(x)$, $cos(x)$, $(1+x)^n$, $log(1+x)$ (with restrictions wherever necessary). Indeterminate form, L'Hospital's rule, maxima and minima (Differentiations and acquaintance with rules of finding extreme, emphasis on solving problems only).</p> <p>Function of two variables, their geometrical interpretation, limit, repeated limit and continuity (definitions and examples only). Partial differentiation, knowledge of chain rules, Exact differential, Differentiation of implicit functions, successive partial derivatives, statement of Schwarz's theorem on the commutative property of mixed partial derivative, Euler's theorem on a homogeneous function of two variables. Applications: Problem on (i)Tangent and normals. (ii)Rectilinear asymptotes of algebraic curves, (iii)Curvature and radius of curvature of plane curves, (iv)Envelope of family of straight lines.</p>

<p style="text-align: center;">Sri. S. Sarkar Assistant Professor</p>	<p>Paper-III, Group-B: Numerical Analysis:- Polynomial interpolation and applications: Lagrangian interpolation problem. Linear interpolation formula. Lagrange's formula.</p> <p>Differences: Forward, backward and divided difference tables. Newton's general interpolation formula with the remainder term, Newton's forward and backward formulae, error in these formulae, Numerical differentiation based on Newton's forward and backward formulae.</p>	P U J A V A C A T I O N	<p>Paper-III, Group-B: Numerical Analysis:- Numerical integration: Newton's-Cotes formula, trapezoidal rule, Simpson's one-third rule and inherent errors. Solution of equations (algebraic and transcendental) : Solution of a single equation by (i) Graphical method. (ii) Bisection method. (iii) Regula falsi method. (iv) Iteration method. (v) Newton-Raphson method. Geometrical interpretation of these methods. Convergence of Iteration- and Newton- Raphson method.</p>
<p style="text-align: center;">Sri. A. De Assistant Professor</p>	<p>Paper-III, Group-A: Linear Programming:- Inequation, definition of linear programming, problems bringing an objective function amongst set of constraints involving inequations. Formation of simple L.P. problems from day to day life, solution of L.P.P. by graphical method, linear dependence of vectors. Basic solutions and basic feasible solutions with reference to L.P.P., Degenerate and non-degenerate B. F. S., hyper-plane, convex set, extreme points, convex hyper-plane and statement of relevant theorems. Statement of the fundamental theorem of L.P.P.</p>		<p>Paper-III, Group-A: Linear Programming:- Reduction of a F. S. to a B. F. S., Transformation of inequations to equations by slack and surplus variables. Simplex method (without proof), Feasibility and optimality conditions. The algorithm, simple application from daily life. Big-M method, Duality theory, The dual of the dual is primal. Definition of Transportation problem and assignment problem and their connection with L.P.P., algorithmic solution of T.P. and A.P. (no proof is required), simple applications.</p>
	<p>Paper-II, Group-B: Integral Calculus:-</p> <p>Indefinite Integration: Standard form, Methods by substitution and Integration by parts (Revision of previous knowledge). Integration of rational function and trigonometric function.</p> <p>Definite Integral as the limit of sum, Geometrical interpretation of definite Integrals of bounded continuous functions, Fundamental theorem of integral calculus, Properties of definite integral and their applications.</p>		<p>Paper-II, Group-B: Integral Calculus:- Reduction formula of $\int_0^{\frac{\pi}{2}} \sin^m x dx$, $\int_0^{\frac{\pi}{2}} \cos^n x dx$, $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x dx$, $\int_0^{\frac{\pi}{2}} \tan^n x dx$ and associated problems (m and n are non-negatives). Definition of improper integrals, working knowledge of Beta and Gamma functions (convergence and important relations being assumed). Working knowledge of double and triple integrals, Jacobian. Application: Rectification (formation of intrinsic equations from cartesian and polar equation). Quadrature, Volumes and surface area of solids formed by revolution of curves and areas.</p>

Sri. S. Roy Assistant Professor	Paper-II, Group-C: Differential Equations:- First order linear and non-linear differential equations, application in simple geometrical problems. Second order linear differential equations with constant coefficient, linear homogeneous second order differential equations.	P U J A V A C A T I O N	Paper-II, Group-C: Differential Equations:- Simultaneous linear differential equation with constant coefficients up to second order. Simple Eigen value problems
	Paper-III, Group-C: Analytical Dynamics:- Impulse and impulsive forces, work, power and energy, principles of conservation of energy and momentum, collision of elastic bodies (loss of K.E. to be calculated in the case of direct of impact only).		Paper-III, Group-C: Analytical Dynamics:- Motion in a straight line under variable forces, damped, forced and damped forced vibration, motion under inverse square law. Velocity and accelerations of a particle in cartesian and polar co-ordinates. Tangential and normal accelerations, circular motion. Motion in a plane, equations of motion in cartesian and polar coordinates, central orbits, escape velocity.
	1st Internal Assessment: 2nd week of September 2018		2nd Internal Assessment: 2nd week of April 2019

JHARGRAM RAJ COLLEGE
DEPARTMENT OF MATHEMATICS
Academic Calendar for the Session 2018-2019
B.Sc. Part-III (General)

Name of Faculty Member	Topic(From 10 th July 2018 to 6 th October 2018)		Topic(From 26 th November 2018 to 28 th March 2019)
Sri. S. Sarkar Assistant Professor	<p>Paper-IV, Group-A: Elements of Computer Science:-</p> <p>Computers and their functions and programming:</p> <p>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.</p> <p>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.</p>	P U J A V C A T I O N	<p>Paper-IV, Group-A: : Elements of Computer Science:-</p> <p>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.</p> <p>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.</p>

<p style="text-align: center;">Sri. A. De Assistant Professor</p>	<p>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.</p>	P U J A V A C A T I O N	<p>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.</p>
	<p>1st Internal Assessment: 2nd week of September 2018</p>		<p>2nd Internal Assessment: 2nd week of March 2019</p>