

Programme Outcomes

(Govt. Jajwalyadev Naveen Girls College Jangir C.G.)

B.Sc. Mathematics

Programme Outcomes

By the end of a B.Sc. programme a student will

- PO1: Recognize and appreciate the connections between theory and applications.
- Po2: Work effectively in multidisciplinary environment.
- PO3: Be prepared for life-long learning.
- PO4: Exhibit positive attitudes and values towards the discipline, so that they can contribute to dynamics society.

Specific outcomes

- PSO1: Be familiar with different areas of mathematics.
- PSO2: Be prepared to use mathematics, not only in the discipline of mathematics but also in other disciplines and in their future endeavors.
- PSO3: Develop the skills necessary to formulate and understand proofs and to provide justification.
- PSO4: Think critically and communicate clearly mathematical concepts and solutions to real world problem.
- PSO5: Develop an understanding of the precise language of mathematics and be able to integrate mathematical arguments with their critical thinking skills.

Course Outcome

B.Sc. Mathematics

Algebra and Trigonometry

Up on

completion of this course students should be able to

- CO1: Identify symmetric, skew symmetric ,Hermitian , skew hermitian and orthogonal matrices.
- CO2: Obtain the inverse of a matrix by elementary operations.
- CO3: Reduce the matrix into normal form and echelon form and can find the rank and nullity of the matrix.
- CO4: Determine the eigenvalues and eigenvectors of a square matrix.
- CO5: Apply the Caley-Hamilton theorem to problems for finding the inverse of the matrix.
- CO6 : Solve the system of linear equation by cramer's rule and by inverse of matrix.

- **CO7: distinguish between consistent and inconsistent of system of linear equations.**
- **CO8:Acquire the knowledge of relationship between coefficient and roots of an equation.**
- **CO9:Explain different methods for finding the roots of an equation.**
- **CO10: Identify the reciprocal equation and solve it.**
- **CO11: acquire the knowledge of different techniques of transforming the equation to convenient form.**
- **CO12: Explain the different methods Cardan's method ,Ferrari method and Descartes method in theory of equation.**
- **CO13: Determine the number of real roots and imaginary roots of the equation.**
- **CO14: Explain the fundamental ideas of sets and functions.**
- **CO15: Determine equivalence relations on sets and corresponding equivalence classes.**
- **CO16: Differentiate between various types of functions and relations.**
- **CO17:Understand binary operation on sets, Group Structure,Subgroup, Cyclic Group,Coset decomposition.**
- **CO 18:Know important structure of group like-Normal subgroup, symmetric group, simple group, Quotient group etc.**
- **CO19: Explain the Homomorphism and Isomorphism mapping between two Groups,properties of Homomorphism, fundamental theorem of Homomorphism.**
- **CO20:To know the important structure like Ring, integral domain, Ideal,prime ideal, maximal and minimal ideal etc.**
- **CO21:Understand De-Moivre's theorem and it's application,Direct and inverse circular and hyperbolic function, logarithm of complex Quantity, Expansion of trigonometrical function ,C+iS method.**

“Calculus”

Upon completion of this course, students should be able to-

- **CO1:Acquire the knowledge of Basic properties of limit, algebra of limit,left and right hand limit, continuity, continuity form left and right hand, discontinuity,kind of discontinuity.**
- **CO2:Understand Basic concept of the derivative of a function, differentiability of function,left and right hand derivative, successive Differentiation and Leibnitz's theorem, Expansion by Maclaurin's and Taylor's series.**
- **CO3:Have a knowledge concept of Asymptotes,to find Asymptotes, Curvature, Radius of curvature, concavity and convexity of function, point of inflexion and multiple point, Tracing of curves.**
- **CO4:Know integration of Transcendental Functions, Reduction formulae, General properties of Definite integral, Length of curves, surface area and volume of solid.**
- **CO5:Know basic concepts of Differential equation, Degree and order of Differential equation, Differential equation reduce to Linear form.**

- CO6:Acquire the knowledge of Exact Differential equation, reduce Differential equation to exact differential equation, Differential equation of first order and higher degree.
- CO6:Understand Linear Differential equation with constant coefficients, finding auxiliary equation and particular intergal.
- CO7:Have a knowledge of Basic properties of linear Differential equation of second order, ordinary simultaneous differential equation of first order etc.

“Vector Analysis & Geometry”

Upon completion of this course, students should be able to-

- CO1:Acquire the knowledge of scalar and vector product of three and four vectors, vector differentiation, Gradient, divergence and curl of the vector.
- CO2:Know vector integration, definite intergal of vector functions, line intergal,surface integral, volume intergal of vector functions.
- CO3:Apply Gauss’s, Green’s and Stoke's theorem.
- CO4:Know General equation of second degree and tracing of conics, eccentricity of conics,nature of conics.
- CO5: Acquire the knowledge of confocal conics ,angle of intersection of two curves ,contact of conics, radical axis.
- CO6:Acquire the complete knowledge of polar equation of conics.
- CO7:Have a knowledge of equation of plane, straight line ,sphere, , equation of cone of given vertex and base, reciprocal cone,right circular cone, enveloping cone,equation of cylinder whose generetor intersect a conic ,right circular cylinder and enveloping cylinder.
- CO8:Know General equation of second degree in three variables, Central conicoids, normal,polar lines, General equation of the paraboloids, tangent plane, condition for tangency.
- CO9:Have a knowledge of plane section of conicoids, generating lines, properties of the parameters,confocal conicoids, elliptic co-ordinate,confocal touching a given plane and reduction of second degree equations etc.

”Advance calculus”

Upon completion of this course, students should be able to-

- CO1:Have knowledge of sequence of real number, bounded sequence, limit of sequence, convergence of sequence, Cauchy sequence, theorems on sequences.
- CO2:Apply Cauchy's general principle of convergence of sequence, Cauchy's first and second theorem on limit.
- CO3:Apply different test (like p-series test, comparison test, Cauchy's integral test ,D'Alembert's ratio tes,t root test,Raabe test, logarithmic test) to check convergence of the series.

- CO4: Acquire the knowledge of absolutely convergence, conditionally convergence of series and Leibnitz test for the convergence of an alternating series.
- CO5: Know continuity of function of one variable, kinds of discontinuity, properties of continuous functions, uniform continuity, differentiability of function, chain rule of differentiability and Darboux's intermediate value theorem. Rolle's theorem, First mean value theorem, Cauchy mean value theorem.
- CO6: Determine the existence of limit and continuity of functions of two variables, iterated limits, mean value theorem for a function of two variables.
- CO7: Know partial differentiation and able to apply Euler's theorem on homogeneous functions and change the independent variable into another variable and have the knowledge of Taylor's theorem for function of two variables and Jacobians of function.
- CO8: To find Evolute and Envelopes of the family of curves, maxima, minima and saddle point of functions of two variables.
- CO9: Have knowledge of Beta and Gamma function, Relation between Beta and Gamma function, Double and triple integrals, change of order of integration in double integrals.

"Differential Equation".

Upon completion of this course, students should be able to-

- CO1: Have the knowledge of power series solution of differential equations, series solution-Frobenius method.
- CO2: Obtain series solution of Bessel's differential equations, Bessel's functions and their properties.
- CO3: Acquire the knowledge of Legendre function and their properties, Legendre differential equations, Christoffel's expansion, Christoffel's summation formula.
- CO4: Know Orthogonality of functions and Sturm-Liouville problem, orthogonal functions, norm of function, the adjoint operator.
- CO5: Determine Laplace transform of functions, inverse Laplace transform, solution of integral equations and system of differential equations using the Laplace transformation.
- CO6: Have knowledge of Partial differential equations of first order, Lagrange's Solution and four standard forms. Charpit's general method of solution.
- CO7: Recognize Partial differential equations of second order and higher order, classify of linear partial differential equations of second order.
- CO8: To find solution of homogeneous and non-homogeneous equations with constant coefficients, know working rule for finding C.F. and P.I. of differential equation.
- CO9: To find solution of differential equations by using Monge's method.
- CO10: Acquire the knowledge of calculus of variations, variational problem with fixed boundaries, Euler's equations, isoperimetric problem.

- CO11: Know Variational problems with moving boundaries for a functional dependent on two functions. Sufficient conditions for an extremum etc.

“Mechanics”

Upon completion of this course, students should be able to-

- CO1: Know definitions of force, moment of force, couple and able to reduce the coplanar forces to a single force and a single couple, equilibrium condition, action and reaction of force, Tension and thrust of force, Lami's theorem.
- **CO2:** Acquire the knowledge of stable and unstable equilibrium, test for determining the nature of stability, virtual work, principle of virtual work. Definition of catenary, intrinsic and Cartesian equations, important properties of catenary.
- **CO3:** Understand force in three dimensions, find the resultant of any given system of forces acting on rigid body and equilibrium condition of a rigid body, Poinsot's Central axis, Null line and null plane, conjugate line.
- **CO4:** Know simple harmonic motion and find the time period, elastic string, Hooke's law of elasticity.
- CO5: Obtain velocity and acceleration along radial and transverse direction. Know Projectile motion and determine the time of flight, displacement, maximum height in projectile motion.
- **CO6: Know the central orbit and obtain differential equation of central orbit. Define apse, apsidal distance.**
- **CO7:** Acquire the knowledge of Kepler's laws of motion, obtain the time of describing a central orbit.
- **CO8: Find** velocity and acceleration in tangential and normal direction. Study the motion on smooth and rough plane curves.
- **CO9:** Have knowledge of motion in a resisting medium, motion in vertical line downward and upward, motion on smooth curve under resistance.
- **CO10:** Acquire the knowledge of motion on a smooth plane curve, equation of motion of varying mass.
- **CO11:** Know Motion of particles in three dimensions.

“Analysis”

Upon completion of this course, students should be able to-

- CO1: Understand sequence, monotone sequence, limit superior limit inferior of sequence and some important properties of sequence.
- CO2: Obtain convergence behaviour of sequence.

- CO3:Determine series of non negative terms, convergence of series and important test of convergence on series like root test,ratio test, Abel's test,Dirichlate's test etc.
- CO4:Know Double series and important test & properties of double series.
- CO5:Know partial derivation,differentiability of function of two variables.
- CO6:Acquire the knowledge of Young's and Schwartz theorem for mixed partial derivative.
- CO7: Obtain Fourier series of function and know Dirichlet's condition.
- CO8: Acquire the knowledge of Riemann integral, properties of Riemann integral ,fundamental theorem of calculus,mean value theorems, improper integral and their test of convergence.
- CO9:Know the integral as a function of one parameter, infinite integrals of one parameter.
- CO10:Define concept of complex number and their geometric representation, modules and argument of complex numbers, properties of moduli and arguments , equation of straight line and circle in form of complex numbers .
- CO11: Understand Analytic function,Cauchy-Riemann equation and obtain conjugate function, analytic function and know properties of analytic function.
- CO12: Acquire the knowledge of Mobius transformation, properties of mobious transformation,fixed point and normal form of Mobious transformation and some special transformations.
- CO13: Know about conformal mapping, necessary and sufficient condition for $f(z)$ to represent a conformal mapping.
- CO14:Understand metric spaces,differentiate between quasi and pseudo metric space, define open sphere , closed sphere,limit point of set, close set, open set, neighborhood of set, completeness properties.
- CO15: Know contraction mapping,Banach contraction principle, fixed point of function.
- CO17: Acquire the knowledge of real numbers, field axioms, order axioms in real number ,positive and negative real number ,absolute value, Archimedean property and density property.
- CO17: Understand countable space,dense space, separable space, first and second countable space.
- CO18:Determine continuity properties of function, uniform continuity properties of function, Homomorphim and isometry of a function.
- CO19:. Define compactness of spaces, connectedness of spaces, sequential compactness,sapareded sets, totally disconnected sets etc.

'Abstract Algebra'

Upon completion of this course, students should be able to:-

- CO1:Identify Group structure,Homomorphim between two Groups, Group isomorphism,Group Automorphisms, Inner Automorphisms on Group.

- CO2: Define conjugacy relation ,normalizer of an element,prove Cauchy's theorem for abelian and non Abelian group.
- CO3:Understand Sylow's theorem and structure theorem for finite Abelian groups.
- CO4:Determine Direct products of two Groups(external and internal direct products).
- CO5:Identify Ring structure $(R,+)$.
- CO6:Understand the definition of Ring structure- Ideal, principal ideal, prime ideal,maximal and minimal ideal, quotient ring etc.
- CO7: Obtain product of two ideals and some theorem on ideals.
- CO8: Know Ring Homomorphism, kernel of a ring Homomorphism.
- CO9: Determine the structure of polynomial ring $R[x]$.
- CO10: Have knowledge of degree of a polynomial,monic polynomial, zeros of a polynomial,irreducibility criterion, greatest common divisor,factorization of polynomial, unique factorization domain.Eulidean domain.
- CO11: Understand concept of Module and properties of Modules (Submodules, algebra of Submodules, Direct product of Modules, Quotient modules, Homomorphism, isomorphism of Modules)
- CO12:Define Vector spaces $V(F)$, subspace,linear sum and direct sum of subspaces, linearly independent and dependent vectors,basis of vector space, dimensions of vector space.
- CO13:Prove properties of vector space, criterion for subspaces, existence theorem, dimension theorem, extension theorem and many more theorems.
- CO14:Obtain linear transformation of Vector spaces, matrix representation of linear transformation.Rank & nullity of linear transformation.
- CO15:Understand Linear functional,dual vector space,dual basis,Annihilator of linear transformation.
- CO16: Determine the eigenvalues and eigenvectors of a linear transformation, diagonalize the matrices.
- CO17: Know orthogonal similar matrices , canonical form of real quadratic form , orthogonal reduction of similar matrices , orthogonal reduction of real quadratic form
- CO18: Identify Bilinear form as vectors, hermitian form, symmetric Bilinear form etc.
- CO19: Define structure of inner product space,normed vector space, distance in an inner product space, orthogonal vectors,orthogonalization of base.
- CO20:Prove Schwartz inequality , Bessel's inequality, Parallelogram law , triangle inequality.

“Discrete Mathematics”

Upon completion of this course, students should be able to:-

- CO1:Know cardinality of sets and apply principle of inclusion and exclusion .
- CO2: Apply mathematical induction method.
- CO3: Explain Language, phrase structure grammar, types of grammars and languages .

- CO4: Apply permutations and combinations.
- CO5: Acquire the knowledge of Probability, conditional probability, independent event, mutually exclusive event, Baye's theorem.
- CO6: Have the knowledge of relation, domain and range, composition of relations, types of binary relations, equivalence relation and classes, partial order relation, POset.
- CO7: Understand Hasse diagram, lattice, dual lattice, some properties of lattices, chain and antichain, Pigeonhole principle.
- CO8: Acquire the knowledge of Graphs and planar graph, walk, path and circuit, connected and disconnected graph, Hamiltonian and Eulerian path, circuits.
- CO9: Apply Euler's formula in planar graph and many more results of graph.
- CO10: Know Trees, rooted trees, binary trees, spanning tree, minimally connected graph, some properties of trees.
- CO11: Explain finite state machines, Machine design, Equivalent machines, minimization of machine.
- CO12: Understand discrete numeric function and generating function.
- CO13: Solve recurrence relation.
- CO14: Acquire the knowledge of Group theory and its important properties-order of group, finite and infinite group, Abelian groups, cycle groups, permutation group, subgroup, algebra of group, coset, quotient group, normal subgroup etc.
- CO15: Have a knowledge of Ring theory and field theory like-some important type of rings (division ring, Boolean ring, commutative ring, unity ring etc), subrings, ring Homomorphism, integral domain, field, subfield, Galois field etc.
- CO16: Understand Lattices as algebraic system, principle of duality, direct product of Lattices, Sub-lattice, types of lattices, Boolean algebra and properties, Boolean function, Boolean expression, CNF, DNF, propositional calculus etc.