Navjivan Science College, Dahod

DEPARTMENT OF MATHEMATICS

B Sc (Mathematics) Programme

Goals:-

The Mathematics program promotes mathematical skills and knowledge for their intrinsic beauty, effectiveness in developing proficiency in analytical reasoning, and utility in modeling and solving real world problems. To responsibly live within and participate in the transformation of a rapidly changing, complex, and interdependent society, students must develop and unceasingly exercise their analytical abilities. Students who have learned to logically question assertions, recognize patterns, and distinguish the essential and irrelevant aspects of problems can think deeply and precisely, nurture the products of their imagination to fruition in reality, and share their ideas and insights while seeking and benefiting from the knowledge and insights of others.

After completing B.Sc (Mathematics) Programme students will be able to:

PO1 : Explain the importance of mathematics and investigate the real world problems and learn to how to apply mathematical ideas and models to those problems.

PO2 : Reason mathematically and apply rigorous, analytic, highly numerate approach to analyze, execute tasks and solve problems in daily life and at work.

PO3 : Recognize the power of abstraction and generalization, and to carry out investigative mathematical work with independent judgment.

PO4 : Investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods

PO5 : Identify the type and solve abstract mathematical problems and give geometrical interpretation of various concepts.

PO6 : Recognize connections between different subjects in mathematics.

PO7 : Develop an understanding of the underlying unifying structures of mathematics (sets, relations and functions, logical structure) and the relationships among them.

PO8 : Conduct self-evaluation, and continuously enrich them through lifelong learning.

PO9 : Communicate and interact effectively with different audiences and collaborate intellectually and creatively in diverse contexts, while emphasizing the importance of clarity and precision in communication and reasoning.

PO10 : Formulate and analyze mathematical problems, precisely define the key terms, and draw clear and reasonable conclusions.

Programme Specific Outcomes (only 3)

PSO1: Help the students to enhance their knowledge in soft skills and Computing skills.

PSO2: Enable the students to equip knowledge in various concepts involved in functions of single variable and functions of several variables.

PSO3: Enable the students to equip knowledge in various concepts involved in Calculus and operation research.

Course Outcomes

F.Y. B Sc (Mathematics)
Sem-1 BSC0C106 :- Calculus and Matrix Algebra
After successfully completing this course, students will be able to:

CO1: Understand Lebniz's theorem and its applications, also learn Taylor's and Maclaurin's Theorem and it's examples.
CO2: Understand Roll's, Lagrange;s and Cauchy's Mean Value theorem and its Application also learn L'Hospital's rule and its examples.
CO3: Understand Matrices and their properties operation on matrices, row reduced echelon form of a matrix
CO4: Understand the eigen value and eigen vector, Cayley-Hamilton theorem and its Application and solve the system of simultaneous linear equations.

Sem-1 BSC0P106:- Practicals
After successfully completing this course, students will be able to:

CO1: Students will learn solve the example of nth order derivative and find the Taylor and Macularin's series of functions cosx, sinx, tanx etc.
CO2: Examples of Role's, Lagrange's and Cauchy's Mean value theorem and find the limit using L'Hospital's rule.
CO3:. Find the the inverse using Gauss-Jordan Method
CO4: Verify Cayley-Hamilton Theorem and Find the eigen value and eigen vectors of the matrix

Sem-2 BSC0C206:- Differential Equations and Co-ordinate Geometry
After successfully completing this course, students will be able to:

CO1: Understand the Linear Differential, Bernouli's Differential Equation, Clairaut's Differential Equation and Lagrange's Differential Equations.
CO2: Understand Higher order Linear Differential equations of degree one with constant coefficients, complementary functions and Particular integral and inverse operator
CO3: Understand Cartesian equations of sphere, Intersections of sphere with line, planes, equations of tangent plane to sphere, orthogonal spheres.
CO4: Understand the relation between the polar and Cartesian coordinate, relation between Cartesian, cylindrical and spherical coordinate , Equations of cone and cylinder.

Sem-2 BSC0P206:- Practicals
After successfully completing this course, students will be able to:

CO1: Solution of differential equations of first order & one degree and first order and higher degree
CO2: Solution of linear differential equations of higher order with constant and variable coefficients.
CO3: Problems on sphere, cone and cylinder
CO4: Problems on transforms between Cartesian, Spherical and Cylindrical coordinate system

S. Y. B Sc (Mathematics)

Sem-3 BSC0C306 A:- Advanced Calculus-I

After successfully completing this course, students will be able to:

- **CO1:** Understand the Limit and continuity of function of two variables.
- **CO2:** Define directional derivative and partial derivatives
- **CO3:** Understand Schwartz's and Young's Theorem
- **CO4:** Find the maxima & minima of functions of two variables.
- **CO5:** Familiar with the necessary and sufficient conditions for extreme points.
- **CO6:** Differentiability Of functions of two variables.
- **CO7:** Understand the Euler's theorem for function of two variables.
- **CO8:** Understand Taylor's and Maclaurin's theorem for function of two variables.
- **CO9:** Understand the radius of curvature for Cartesian, parameter, polar equations of curve in two dimensional.

Sem-3 BSC0C306 B:- Linear Algebra-I

After successfully completing this course, students will be able to:

- **CO1:** Understand Vector Space, Subspace, Span of a set, Addition and direct sum of subspace
- **CO2:** Linear Dependence and Independence, Basis and Dimension
- **CO3:** Understand Dimension Theorem
- **CO4:** Understand Linear Transformation, Range and Kernel of a Linear Transformation.
- **CO5:** Understand the Rank-Nullity theorem
- **CO6:** Understand the Matrix associated with Linear map and Linear map associated with Matrix.
- **CO7**: Verification of Rank-Nullity theorem for matrices

Sem-3 BSC0P306:- Practicals

After successfully completing this course, students will be able to:

- **CO1:** Examples of find the limit and continuity of function of two variables.
- **CO2:** Verify Euler's theorem examples
- **CO3:** Examples of Lagrange's method of Undermined multiplers.
- **CO4:** Find the maxima and minima of function's of two varibles
- **CO5:** Examples of vector space, subspace and basis
- **CO6:** Examples of Linear transformation and verify Rank-Nullity Theorem
- **CO7:** Examples of Matix associated with Linear map and Linear map associated with the Matix.
- **CO8:** Examples of Gauss Jacobi and Gauss Seidel iterative method.

Sem-4 BSC0C 406 A:- Advanced Calculus-II

After successfully completing this course, students will be able to:

- **CO1:** Understand the double integration, triple integration
- **CO2:** Concept of change of order of integration
- **CO3:** Understand the Beta and Gamma function, relation between Gamma and Beta function
- **CO4:** Understand the Duplication formula.
- **CO5:** Understand Green's and Stoke's theorem.
- **CO6:** Understand the Gradient, Curl and Divergence and it's properties.
- **CO7:** Understand the Partial Differential equations of first order
- **CO8:** Understand the Lagrange's and Charpit's method for Partial differential equations.

Sem-4 BSC0406 B:- Numerical Analysis
After successfully completing this course, students will be able to:

CO1: Understand Newton's forward and backward interpolation formula for equal space.
CO2: Understand Gauss's forward and backward interpolation formula for equal space.
CO3: Understand Bessel's and sterling interpolation formula for equal space.
CO4: Understand the Lagrange's and Newton's Divided formula for uneual space
CO5: Understand the Numerical Integration by Trapezoidal, Simpson's 1/3 and Simpson's 3/8 Rule.
CO6: Use Taylor's series method and Picard's method to solve the ordinary differential equations.
CO7: Understand the Newton- Raphson's formula and False Position method

Sem-4 BSC0P406:- Practicals
After successfully completing this course, students will be able to:

CO1: Find the root of equation using graphical and bisection method
CO2: Examples of Newton's forward and Newton's backward interpolation formula
CO3: Examples of Gauss's forward and Gauss's backward interpolation formula
CO4: Examples of Sterling and Bessel's interpolation formula
CO5: Examples of Lagrange's and Newton's divided interpolation formula
CO6: Examples of Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rule for finding the Numerical integration.
CO7: Problems on Change the order of double integration
CO8: Problems on Gamma and Beta functions
CO9: Problems on Green's Theorem
CO10: Problems on Stock's Theorem

T. Y. B Sc (Mathematics)

Sem-5 BSC0C506 A:- Analysis-I
After successfully completing this course, students will be able to:

CO1: Have a knowledge of important mathematical concepts sets, elements, functions.
CO2: Understand the concept of countable and uncountable stes.
CO3: Find the Greatest lower bound and least upper bound
CO4: Understand the concepts of sequences and limit of the sequence.
CO5: Understand the concept of convergent sequence and divergent sequence,bounded sequence, monotone sequence, Cauchy sequence.
CO6: Understand the Complex numbers and root of complex numbers
CO7: Understand the De-Moivre's Theroem.
CO8: Understand the Limit, Continuity and Differentiability of complex functions
CO9: Understand the Analytic functions and Cauchy-Reimann equations.
CO10: Understand the Harmonic function
CO11: Understand the Linear Transformation and Linear fractional transformation and implicit form of Linear transformation.

Sem-5 BSC0C506 B:- Abstract Algebra-I
After successfully completing this course, students will be able to:

CO1: Understand the concept of relation, equivalence relation and congruence relation in Z.
CO2: Understand the Group, finite group, commutative and non commutative group.
CO3: Understand Lagrange's theorem, Euler's theorem, Fermat's theorem.
CO4: Understand subgroup, homomorphism, isomorphism, isometric groups,
CO5: Understand Automorphism and ,Cayley's theorem.
CO6: Understand permutation groups, cycles, alternating group.
CO7: Understand Normal subgroup, Quotient group

Sem-5 BSC0C506 C:- Linear Algebra-II
After successfully completing this course, students will be able to:

CO1: Understand the concepts of composition of linear maps, Linear operator
CO2: Understand the concept of Dual space, Dual basis existence Theorem
CO3: Understand Annihilators of set and Bilinear form.
CO4: Understand the Inner Product space, Cauchy-Scwartz inequality,
CO5: Understand the Gram-Schmidt Orthogonalization process, Orthogonal complement and Orthogonal Linear Transformation
CO6: Understand Determinants and their properties, Laplace expansion and Crammer rule.
CO7: Understand Eigen-values and eigen vectors, Cayley-Hamilton theorem
CO8: Understand the Diagonalization of real and symmetric matrix, Spectral theorem

Sem-5 BSC0C506 D:- Operation Research-I
After successfully completing this course, students will be able to:

CO1: Understand the concepts of convex set, Extreme points on the convex set, convex combination.
CO2: Understand the formulation techniques of LPP.
CO3: Understand the Simplex, Big-M, Two-Phase and Gomory cutting method for LPP.
CO4: Understand the dual problem, primal problem into it's dual and Dual Simplex method.
CO5: Understand the North-West corner, Least cost, vogel's Approximation and Modi method for Transportation problem.
CO6: Understand degeneracy in transportation problem and Unbalanced transportation problem
CO7: Understand Hungarian method for Assignment Problem.

Sem-5 BSCSE506: Number Theory (E.C.)
After successfully completing this course, students will be able to:

CO1: Understand the Well-ordering Principle, Mathematical induction, Binomial theorem
CO2: Understand the concepts of divisibility of integers, Prime numbers
CO3: Understand the division algorithm, GCD of two integers
CO4: Understand the Euclidean algorithm
CO5: Find the remainder and quotient by division algorithm.
CO6: Understand the relation between gcd and lcm.

CO7: Find the solution of Diophantine equations in two variables.
CO8: Classify prime and composite numbers.
CO9: Understand the concept of sieve of Eratosthenes.
CO10: Understand the theory of congruence.
CO11: Understand the properties of congruence.
CO12: Understand Chinese Remainder Theorem
CO13: Understand the Fermat's and Wilson Theorem
CO14: Understand the Euler's Phi-function its properties and Euler's Theorem
CO15: Understand the sum and Number of divisors
CO16: Understand the Mobius Inversion formula and greatest integer function

Sem-5 BSC0P506A:-Practical-1
After successfully completing this course, students will be able to:

CO1: Understand the countable and uncountable sets
CO2: Find the supremum and infimum of sets.
CO3: Understand the Cauchy sequence and it's examples.
CO4: Understand the De-Moivere's Theorem's examples for finding nth root of complex number.
CO5: Verify Cuchy-Reimann equation
CO6: Find the harmonic conjugate of a function and find corresponding analytic function.
CO7: Examples on the transformation under $w=1/z$.
CO8: Examples on equivalence relation.
CO9: Examples on group, Subgroup, Cyclic group and Lattice Diagram.
CO10: Examples on odd and even permutation and order of permutation.
CO11: Examples on Quotient group.

Sem-5 BSC0P506B:- Practical-2
After successfully completing this course, students will be able to:

CO1: Example on Solving operator equation
CO2: Example on finding the dual bases using dual-basis existence theorem
CO3: Example on inner product space
CO4: Example on orthogonalization and orthonormalization of basis using Gram-Schmidt orthogonalization process.
CO5: Example on finding the determinant using its properties.
CO6: Example on finding the eigen value and eigen vector of square matrix.
CO7: Example on verify Cayley-Hamilton Theorem.
CO8: Example on Digonalization of square matrix.
CO9: Solve the Linear programming problem using graphical, Simplex, Big-M, Two-phase method.
CO10: Solve the transportation problem using North-west corner, Least cost and Vogel's Approximation for balanced and unbalanced
CO11: Solve the Assignment problem using Hungarian method.

T. Y. B Sc (Mathematics)

Sem-6 BSC0C606 A:- Analysis-II
After successfully completing this course, students will be able to:

CO1: Understand the Reimann integration and their properties.
CO2: Understand the Fundamental theorem of Calculus
CO3: Understand the first and second mean value theorems.
CO4: Understand the convergence of series using p-test, De-Alembert's raio test, Cauchy root's test, Cauchy condensation test.
CO5: Understand Absolute convergence and conditionally convergence of the alternating series.
CO6: Understand the rearrangement of series, Cauchy's product of series and Merten's theorem.
CO7: Understand the power series and radius of convergence of power series
CO8: Understand improper integral of first and second kind
CO9: Understand the Taylor's theorem with Lagrange and Cauchy's form of remainder.
CO10: Understand the Binomial series theorem.
CO11: Understand the Power series solution of ordinary differential equations.

Sem-6 BSC0C606 B:- Analysis-III
After successfully completing this course, students will be able to:

CO1: Understand the Metric Space
CO2: Understand the Open sets, Closed sets, limit points
CO3: Understand the convergence of sequence in metric space and completeness
CO4: Understand the continuity and their properties
CO5: Understand the Compactness and their properties.
CO6: Understand the Connectedness and their properties.
CO7: Understand the pointwise convergence of series and sequence of functions.
CO8: Understand the Uniform convergence of series and sequence of functions.
CO9: Understand the Able's limit theorem.
CO10: Understand the Weirstrass Approximation Theorem.

Sem-6 BSC0C606 C:- Abstract Algebra-II
After successfully completing this course, students will be able to:

CO1: Understand the concept of ring, finite ring, division ring, Boolean ring
CO2: Understand ideal and quotient rings.
CO3: Understand subring and their properties.
CO4: Understand Euclidean ring.
CO5: Understand the Integral domain, zero divisors,
CO6: Understand the Homomorphism and Kernel of a Homomorphism of a ring.
CO7: Understand the isomorphism and Fundamental theorem of ring homomorphism.
CO8: Understand the Polynomial ring and degree of a polynomial.
CO9: Understand the Division algorithm of Polynomials
CO10: Understand the irreducibility of polynomial over the field
CO11: Understand the zeros of polynomial, rational zeros of polynomial
CO12: Understand the Eisentein's criterion for irreduciblity of polynomial.

CO13: Understand the field, subfield and extension field.
CO14: Understand the Maximal ideal and Prime ideal.

Sem-6 BSC0C606 D:- Graph Theory
After successfully completing this course, students will be able to:

CO1: Understand the graphs, degree of a vertex, path and cycles
CO2: Understand the Adjacent and Incidence matrix of the graphs.
CO3: Understand the operations on the graphs
CO4: Classify the graph such as walks, paths, circuits
CO5: Draw all types of graphs.
CO6: Understand the concept of Euler's graph and its application.
CO7: Classify Hamiltonian graphs, circuits and paths.
CO8: Explain Konigsberg bridge problem, seating problem
CO9: Understand the concept of trees
CO10: Know about properties of trees, know about distance between two vertices

Sem-6 BSCSE606:- Operation Research-I
After successfully completing this course, students will be able to:

CO1: Understand the various types of Inventory and cost of inventory.
CO2: Understand the EOQ model with constant rate of demand, finite replenishment rate.
CO3: Understand the EOQ model with shortage and order-Level Lot size system.
CO4: Understand the difference between PERT and CPM
CO5: Construct the project work and finding the critical path.
CO6: Interpretation of floats, total floats and free float.
CO7: Understand the two-person zero-sum games.
CO8: Understand the Mixed strategies, Solution of mixed strategies by oddments method, matrix method and iterative method
CO9: Understand the types of simulation, Monte carlo simulation, Network simulation and generalization of random numbers.

Sem-6 BSC0P606A:-Practical-1
After successfully completing this course, students will be able to:

CO1: Examples of evaluation Riemann integration by various method.
CO2: Problems on fundamental theorem of calculus and verify Mean value theorem
CO3: Examples on convergence of positive infinite series.
CO4: Examples on Absolute and Conditionally convergence of the series.
CO5: Examples on finding the radius of convergence of power series.
CO6: Examples on improper integrals of first and second kind.
CO7: Examples on power series expansion of functions.
CO8: Examples on power series solution of first order differential equations.
CO9: Examples on metric space.
CO10: Examples on uniform convergence of sequence.
CO11: Examples on uniform convergence of series
CO12: Examples on term by term integration and differentiation of series.
CO13: Examples on multiplication of power series.
CO14: Examples on exponential, logarithmic and trigonometric functions.

Sem-6 BSC0P606B:-Practical-2
After successfully completing this course, students will be able to:

CO1: Examples on verification of ring, commutative ring and finite ring and their table
CO2: Examples on ideal and integral domain.
CO3: Examples on finite field and quotient ring
CO4: Examples on finding the g.c.d. of two polynomial and express as a linear combination of these two polynomials.
CO5: Check the irreducibility of the polynomial over the given field.
CO6: Examples on finding the rational zeros of a polynomial and factorization it.
CO7: Examples on maximal ideal and prime ideal.
CO8: Using the adjacency matrix determine whether the given graph is connected or not.
CO9: Using fusion algorithm whether given graph is connected or not.
CO10: Find minimal spanning tree using Kruskal's and Prism algorithm.
CO11: Using Breath first search, Back-tracking and Dijkstra's algorithm find shortest path between two vertices of a given connected graph.
CO12: Using Fleury's algorithm Euler tour and Euler's graph.