Government Science College, Vankal

DEPARTMENT OF MATHEMATICS

BSc (Mathematics) Programme

Programme Outcomes:

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 (only3)

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

Course Outcomes

F.Y. B.Sc. (Mathematics)

Course MTH-101: Mathematics-I (SEM- I)
After successfully completing this course, students will be able to:

CO1: Understand De'Moirve's theorem and its applications.
CO2: Understand Euler's Expression, Understand Hyperbolic functions for real arguments.
CO3: Understand the exponential, Circular and Hyperbolic functions for complex arguments.
CO4: Understand the Logarithm of complex numbers, inverse hyperbolic functions and separation of these into real and imaginary parts.

Course MTH-102: Mathematics-II (SEM- I)
After successfully completing this course, students will be able to:

CO1: Understand Successive differentiation, nth derivatives, Understand the application of Leibnitz theorem,
CO2: Understand Rolle's theorems and their geometrical interpretation, understand the use of Cauchy's theorem, and understand the use of Maclaurin and Taylor's Expansions.
CO3: Understand the curvatures, asymptotes, concavity and convexity, understand the decreasing and increasing functions.
CO4: Able to derive the reduction formula of integration of various functions.

Course MTH-201: Mathematics-III (SEM- II)
After successfully completing this course, students will be able to:

CO1: Understand matrices and types of matrices, operations on matrices.
CO2: Understand elementary row operations, row-echelon form, row rank, inverse of matrix by elementary row operations.
CO3: Understand diagonalization, trace of matrix, solving the system of homogeneous and non-homogeneous linear equation by row-reduced echelon form.
CO4: Understand characteristic equation of a matrix, eigen values and vectors, Cayley-Hamilton theorem, inverse of a matrix using Cayley-Hamilton theorem.

Course MTH-202: Mathematics-IV (SEM - II)
After successfully completing this course, students will be able to:

CO1: Understand the curve tracing and parametric equations.
CO2: Understand application of integral calculus, length of a curve, intrinsic equations.
CO3: Understand linear differential equations of first order, exact equations, Bernoulli's equations, Lagrange's equation, Clairaut's equation.
CO4: Understand linear differential equations with constant coefficients.

S.Y. B.Sc. (Mathematics)

Course MTH-301: Mathematics-V (Sem-III)
After successfully completing this course, students will be able to:

CO1: find the differentiation, understand the difference between partial and total differentiation.
CO2: Recognize composite function, homogeneous functions, Euler's theorem for homogeneous function.
CO3: solve examples using Taylor's theorem, Maclaurian's expansion and find Jacobian.
CO4: find the maxima & minima of functions of two variables.
CO5: familiar with the necessary and sufficient conditions for extreme points.
CO6: find the derivatives of vector point function.
CO7: find the gradients, curl, and divergence.
CO8: Understand integral and find the line integral.

Course MTH-302: Mathematics-VI (Sem-III)
After successfully completing this course, students will be able to:

CO1: familiar with the concept of 'error'.
CO2: find the error in various calculations.
CO3: apply Bisection, Iteration, Regula-falsi and Newton-Raphson's methods to find the real roots of transcendental equations.
CO4: understand the concept of finite differences.
CO5: learn how to construct forward, backward and central difference table.
CO6: familiar with numerical interpolation and approximation of functions

Course MTH-303: Mathematics-VII (Sem-III)
After successfully completing this course, students will be able to:

CO1: Identify various types of ordinary differential equations and find their general solution.
CO2: understand applications of differential equations.
CO3: solve linear differential equations.
CO4: apply various methods to solve ordinary differential equations.
CO5: form partial differential equations.
CO6: solve partial differential equations by applying some special methods.

Course EG-3002: Group of Symmetries-I (Sem-III)
After successfully completing this course, students will be able to:

CO1: Understand the group and its types.
CO2: Understand the subgroup.
CO3: Know the concept of symmetry.
CO4: Understand symmetry operations and symmetry elements.
CO5: Identify types of symmetry elements and symmetry operations.
CO6: Understand the product of symmetry operations.

Course MTH-401: Mathematics-VIII (Sem-IV)
After successfully completing this course, students will be able to:

CO1: know Beta-Gamma functions, relate Beta and Gamma functions.
CO2: understand the application of Beta-Gamma functions.
CO3: find double and triple integral.
CO4: change the order of double integral and find the area using integration.
CO5: know Laplace transform, understand Laplace transform of some elementary functions
CO6: know inverse Laplace transform and properties of inverse Laplace transform.

Course MTH-402: Mathematics-IX (Sem-IV)
After successfully completing this course, students will be able to:

CO1: familiar with finite difference with unequal interval.
CO2: apply Lagrange's, Divided differences and Newton's general interpolation formula.
CO3: understand the numerical differentiation.
CO4: apply Newton's forward and backward difference interpolation formulae to find first and second order derivatives.
CO5: understand the numerical integration.
CO6: apply Trapezoidal and Simpson's rule to evaluate integration.
CO7: use Taylor's series method, Picard's method and Euler's method to solve the ordinary differential equations.

Course MTH-403: Mathematics-X (Sem-IV)
After successfully completing this course, students will be able to:

CO1: have knowledge of important mathematical concepts sets, elements, functions.
CO2: understand the concept of countable and uncountable sets.
CO3: find the greatest lower bound (GLB) and least upper bound (LUB)
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 concept of divisibility.
CO7: find gcd, lcm and understand the relation between gcd and lcm.
CO8: classify prime and composite numbers.
CO9: understand the theory of congruence and properties of congruence.
CO10: understand equivalence classes.

Course EG-4002: Group of Symmetries-II (Sem-IV)
After successfully completing this course, students will be able to:

CO1: Understand group of symmetries of plane figures such as isoscele triangle, equilateral triangle, rectangle and a square.
CO2: Understand group of symmetries of chemical molecules such as $H_2O, H_2O_2, Trans\ N_2 - F_2,\ NH_3, PCl_3, CHCl_3$.
CO3: Understand isomorphism of groups.

T.Y. BSc (Mathematics)

Course MTH-501: Group Theory (SEM-V)
After successfully completing this course, students will be able to:

CO1: understand the concept of cosets, congruence relation in group.
CO2: understand Lagrange's theorem, Euler's theorem, Fermat's theorem.
CO3: understand subgroup, homomorphism, isomorphism, isometric groups,
CO4: understand automorphism and Cayley's theorem.
CO5: understand permutation groups, orbit, cycles, alternating group.

Course MTH-502: Linear Algebra-I (SEM-V)
After successfully completing this course, students will be able to:

CO1: understand the concepts of base and dimension of vector space.
CO2: understand the concept of subspace of a vector space.
CO3: understand span of a set, operations on subspaces.
CO4: identify linearly independent and linearly dependent vectors.
CO5: extend linearly independent set to a basis.

Course MTH-503: Real Analysis– I (SEM-V)
After successfully completing this course, students will be able to:

CO1: understand the concepts of countable set, uncountable set, lub, glb of a sequence.
CO2: understand the concepts of sequences and limit of the sequence.
CO3: understand the concept of convergent sequence and divergent sequence, bounded sequence, monotone sequence, Cauchy sequence
CO4: understand the operations on sequences.
CO5: understand the concept of limit superior and inferior.

Course MTH-504: Real Analysis– II (SEM-V)
After successfully completing this course, students will be able to:

CO1: understand the concept of limit and continuity of a function on the real line.
CO2: understand the concept of metric space.
CO3: explain convergence and divergence of sequence in metric space.
CO4: understand the Cauchy's sequence in metric space and equivalent metrics.
CO5: understand the concept of an open ball in $R^1$and metric space.
CO6: understand the continuity of a function in a metric space.
CO7: understand the concept of open sets.

Course MTH-505: Graph Theory (SEM-V)
After successfully completing this course, students will be able to:

CO1: understand about Graph
CO2: identify the properties of different types of graph and their application
CO3: understand the concept of sub graphs and isomorphism.
CO4: understand the operations on the graphs.
CO5: classify the graph such as walks, paths, circuits.
CO6: draw all types of graphs.
CO7: understand the concept of Euler's graph and its application.
CO8: classify Hamiltonian graphs, circuits and paths.
CO9: explain Konigsberg bridge problem, seating problem, utility problem, arrangement problem.
CO10: understand the concept of trees.
CO11: know about properties of trees, know about distance between two vertices, centre, radius and diameter of a tree.
CO12: identify rooted and binary trees.

Course MTH-506: Number Theory-I (SEM-V)
After successfully completing this course, students will be able to:

CO1: understand the concept of divisibility of integers.
CO2: use terminology in number theory.
CO3: understand the division algorithm.
CO4: understand gcd of two integers.
CO5: understand the Euclidean algorithm.
CO6: find the remainder and quotient by division algorithm.
CO7: understand the relation between gcd and lcm.
CO8: find the solution of Diophantine equations in two variables.
CO9: classify prime and composite numbers.
CO10: understand the concept of sieve of Eratosthenes.
CO11: understand the theory of congruence.
CO12: understand the properties of congruence.

Course EG-5001: Operations Research-I (SEM-V)
After successfully completing this course, students will be able to:

CO1: understand the basics of operations research.
CO2: Recognize all the definitions and concepts by giving examples of operations research.
CO3: formulate the problem as linear programming problem.
CO4: understand the primal and dual of lpp.
CO5: plot the graph of lpp.
CO6: solve the lpp by graphical method.
CO7: understand the concept of solutions of lpp.
CO8: solve the lpp by simplex method.
CO9: solve the lpp by two-phase method.
CO10: solve the lpp by Big-M method.
CO11: Choose appropriate method for solving lpp.

Course MTH-601: Ring Theory (SEM-VI)
After successfully completing this course, students will be able to:

CO1: understand the concept of ring homomorphism and isomorphism.
CO2: understand ideal and quotient rings.
CO3: understand maximal ideal and principal ideal,
CO4: understand Euclidean ring.
CO5: understand divisibility in commutative ring.
CO6: understand gcd of two elements in ring.
CO7: understand units and associates in rings.
CO8: understand prime element in a Euclidean ring.
CO9: use unique factorization theorem in a Euclidean ring.
CO10: understand polynomial ring.
CO11: understand degree of a polynomial.
CO12: understand division algorithm and irreducible polynomial.

Course MTH-602: Linear Algebra-II (SEM-VI)
After successfully completing this course, students will be able to:

CO1: recall the definition of vector space.
CO2: understand the concept linear transformations.
CO3: understand range and kernel of linear transformation.
CO4: understand rank-nullity theorem.
CO5: apply the rank-nullity theorem.
CO6: form a matrix associated with linear transformation.
CO7: understand the inner product and norm of a vector.
CO6: understand Gram-Schmidth orthogonalization process.

Course MTH-603: Real Analysis– III (SEM-VI)
After successfully completing this course, students will be able to:

CO1: understand the concepts of convergence and divergence of series of real numbers.
CO2: understand the concepts of alternating, conditional and absolute convergence.
CO3: test for absolute convergence.
CO4: understand the definition of Riemann integral. **CO5:**
state the algebraic properties of Riemann integral. **CO6:**
know the mean value theorem of integral calculus.

Course MTH-604: Real Analysis– IV (SEM-VI)
After successfully completing this course, students will be able to:

CO1: know the limit points, closure of a set, closed sets.
CO2: understand the concept of homomorphism of metric space.
CO3: understand the dense set.
CO4: know the connected sets, bounded sets, totally bounded sets.
CO5: understand the concept of complete metric spaces.
CO6: understand the contraction mapping.
CO7: understand the Picard's fixed point theorem.
CO8: understand the concept of compact metric space.
CO9: understand the concept of open covering.
CO10: understand the Heine-Borel property.
CO11: understand the finite intersection property.

Course MTH-605: Discrete Mathematics (SEM-VI)
After successfully completing this course, students will be able to:

CO1: apply the Set theory and Relation concepts.
CO2: find glb and lub of sets.
CO3: draw Hasse diagram.
CO4: understand the lattice and its properties.
CO5: classify the different types of lattice.
CO6: understand the concept of Boolean algebra.
CO7: represent Boolean function as sum of product canonical form.
CO8: represent Boolean function as product of sum canonical form.
CO9: minimize the Boolean function using Boolean algebra.
CO10: design the circuits using logic gates.
CO11: reduce the switching circuit diagram.

Course MTH-606: Number Theory-II (SEM-VI)
After successfully completing this course, students will be able to:

CO1: solve the linear congruence.
CO2: apply Chinese-Remainder theorem to find the solution of simultaneous linear congruences.
CO3: apply Fermat's little theorem to compute powers of integers modulo prime numbers.
CO4: understand the concept of pseudo-primes.
CO5: apply the Wilson's theorem.
CO6: understand the concept of the Mobius inversion formula.
CO7: understand the Euler's Phi-function.
CO8: understand the Euler's theorem.

Course EG-6001: Operations Research-II (SEM-VI)
After successfully completing this course, students will be able to:

CO1: identify the balanced and unbalanced transportation problem.
CO2: find the solution of transportation problem.
CO3: identify the balanced and unbalanced assignment problem.
CO4: find the solution of an assignment problem.
CO5: understand the terminology of Games.
CO7: identify the game without saddle point and with saddle point.
CO8: solve the game with mixed strategies.
CO9: use graphical method to solve $m\times 2$ or $2\times n$ games.

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