# B. Sc. General in Mathematics

Programme Specific Outcome (PSO)

By the end of the program B. Sc. General in Mathematics, the student will be able to:

- Students should formulate, analyze and solve complex and diverse problemsthrough analytical and computational techniques and apply them to other disciplines whenappropriate.
- Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological challenges.
- Analyses, test, and interpret technical arguments, and form independent judgments.
- Gather and organize relevant qualitative and quantitative information such as related problems, examples, and counterexamples.
- The graduates will be able to communicate mathematical ideas viaextended, clear, and well-organized written presentations.
- The mathematics degree will prepare students for careers in the corporate sector, techindustry, and government agencies
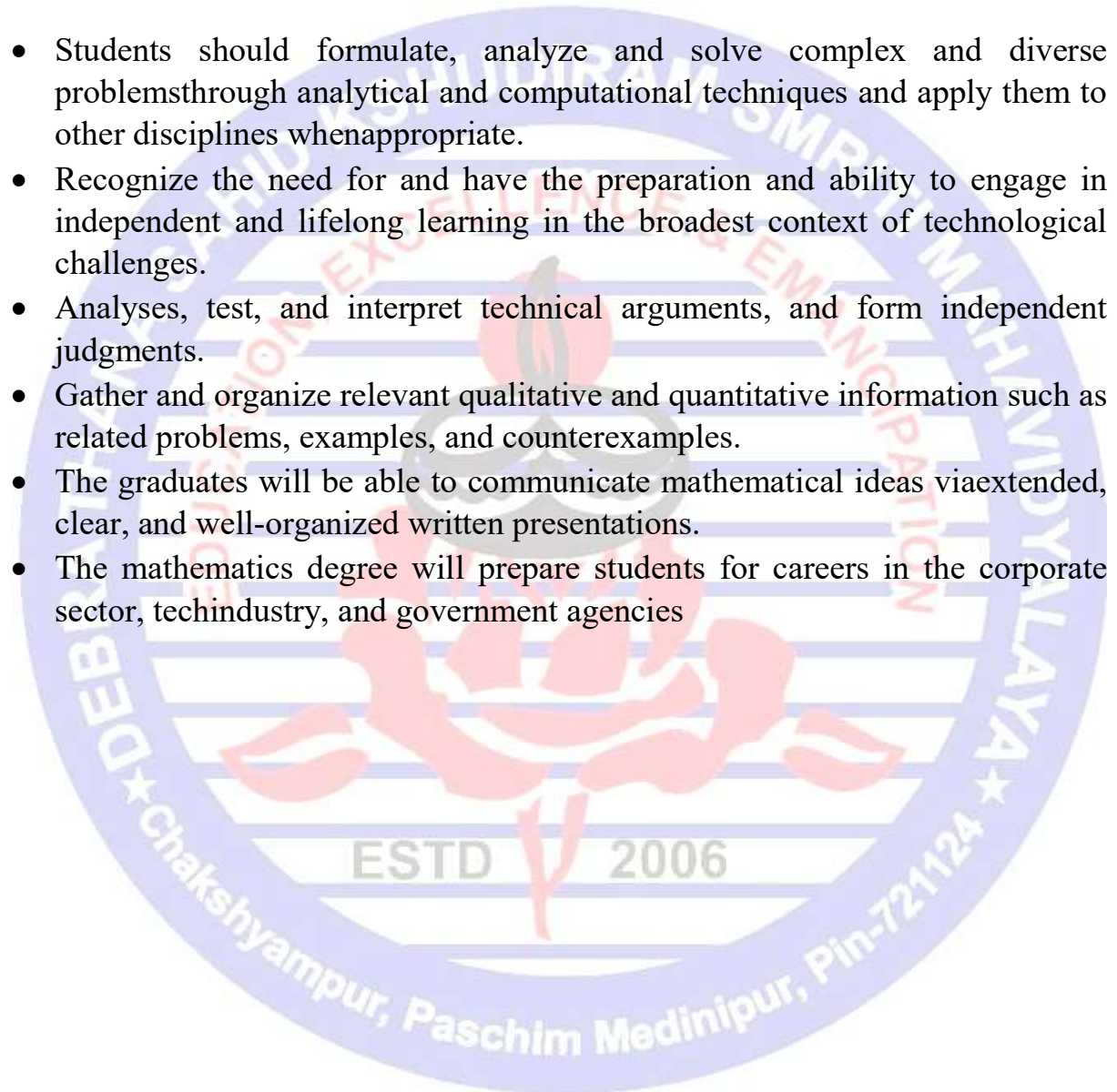
Course Outcome (CO)

MTMGCC01 Differential Calculus

<u>**Outcomes:**</u>
- Students will learn about concepts aboutLimit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, and Euler's theorem on homogeneous functions.
- Students can solve problems on Tangents and normals, Curvature, Asymptotes, Singular points,
- Students can tracevarious curves and are able to understand about Parametric representation of curves and tracing of parametric curves, Polar coordinates, and tracing of curves in polar coordinates.
- Students will know about Rolle's theorem, Mean Value theorems, and Lagrange and Cauchy theorems. Taylor's theorem with Lagrange's and Cauchy's forms of the remainder, Power series and its convergences. Taylor's series, Maclaurin's series of $\sin x$, $\cos x$, e^x, $\log(1+x)$, $(1+x)^m$, Maxima and Minima, and Indeterminate forms.

MTMGCC02 Differential Equations

<u>**Outcomes:**</u>
- Students will able to solve 1^{st}order exact differential equations,1st order higher degree equations solvable for x, y, p, higher-order differential equations,Linear homogenous equations with constant coefficients, Linear non-homogenous equations, the Cauchy-Euler equation, Simultaneous differential equations, and Total differential equations.
- Students will learn about integrating factors, rules to finding an integrating factor,methods for solving Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.
- Students can find out solutionstodifferential equations by the methodof variation of parameters.
- Students will learn aboutthe order and degree of partial differential equations, the concept of linear and non-linear partial differential equations, the formation of first-order partial differential equations, linear partial differential equations of the first order, Lagrange's method, Charpit's method.
- Students can classification of second-order partial differential equations into elliptic, parabolic, and hyperbolic.
- Students will able to findthe power series solution of a differential equation.

MTMGCC03 Real Analysis

<u>**Outcomes:**</u>
- Students will learn about sets, suprema, and infima of sets, completeness property of R, Archimedean property of R, intervals, and cluster points.
- Students will gather knowledge about the Real Sequence,the Infinite series, the sequences,the series of functions, and the power series and their properties.

MTMGCC04 Algebra
Outcomes:

MTMGSE01 Theory of Equation

Outcomes:
- Students will know the definition and examples of abelian and non-abelian groups.
- Students will learn about these special groups like
  i)   The group Zn of integers under addition modulo n,
  ii)   The group U(n) of units under multiplication modulo n.
  iii)   complex roots of unity,
  iv)   circle group,
  v)   the general linear group GLn (R),
  vi)   groups of symmetries of an isosceles triangle, an equilateral triangle, a rectangle, and a square,
  vii)   the permutation group,
  viii)   Group of quaternions.
- Students can solve problems on Cyclic groups from number systems,subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of the group, and examples of subgroups including the center of a group.
- Students will learn about cosets, the order of an element, and Normal subgroups.
- Quotient groups.
- Students can learn definitions and properties of Rings, Fields, Subring, Sub Field, Integral Domain, and Ideals.
- Students can gather knowledge about number systems, Zn the ring of integers modulo n, the ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

MTMGSE02 Graph Theory

Outcomes:
- Students knows about definition, examples and basic properties of graphs, pseudo graphs, complete graphs, bipartite graphs isomorphism of graphs.
- Student will learn about Eulerian circuits, Eulerian graph, semi-Eulerian graph, theorems, Hamiltonian cycles,theorems Representation of a graph by matrix, the adjacency matrix, incidence matrix, weighted graph,
- Student will learn about Travelling salesman's problem, shortest path, Tree and their properties, spanning tree, Dijkstra's algorithm, Warshall algorithm.

MTMGSE03 Number Theory

Outcomes:
- Student will know about Linear diophantine equation, prime counting function, statement of prime number theorem, Goldbach conjecture, linearcongruences, complete set of residues. Chinese remainder theorem, Fermat's little theorem, Wilson's theorem.
- Students will learn about Number theoretic functions, sum and number of divisors, totally multiplicative functions, definition and properties of the Dirichlet product, the

Mobius Inversion formula, the greatest integer function, Euler's phi-function, Euler's theorem, reduced set of residues, some properties of Euler's phi-function.

- Student will improve their concepts on order of an integer modulo n, primitive roots for primes, composite numbers having primitive roots, Euler's criterion, the Legendre symbol and its properties, quadratic reciprocity, quadratic congruences with composite moduli. Public key encryption, RSA encryption and decryption, the $x^2 + y^2 = z^2$, Fermat's Last theorem.

MTMGSE04 Probability and Statistics

Outcomes:
- Student will learn about Sample space, Probability axioms, Real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.
- Students can solve problems on Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, the expectation of a function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function and calculation of covariance, linear regression for two variables.
- Students will learn about Chebyshev's inequality, (weak) law of large numbers and strong law of large numbers,the Central limit theorem for independent and identically distributed random variables with finite variance, Markov chains, Chapman-Kolmogorov equations, and classification of states.
- Students can solve problems on Random Samples, Sampling Distributions, Estimation of parameters, and Testing of hypotheses.

MTMGDS01 Vector Calculus and Analytical Geometry

Outcomes:
- Students will able to solve differential equations 2nd order and know about the power series solution of a differential equation.
- Students will obtain the basic concepts of vector differentiation.
- Students will be able to classify the conics with the help of a determinant and find their canonical forms.
- Students will have clear concepts about the polar coordinate section.
- Students will know about the classification of quadratic equations representing lines, parabolas, ellipses, and hyperbolas. Spheres, Cylindrical surfaces.

MTMGDS02 Linear Programming

Outcomes:

- Students will learn the definition and formation of a linear programming problem,

- Students can find various types of solutions an LPP by graphical approach, simplex method, two-phase method, and Big-M method.
- Students can learn about the convex sets, duality, formulation of the dual problem, primal- dual relationships, economic interpretation of the dual.