(University of Delhi)
Shyam Lal College

Programme Specific Outcomes and Course Outcomes

B.Sc. (P) Mathematics

Programme Specific Outcomes

Programme	Programme Specific Outcomes
B.Sc. (Physical Science)	**PSO-1:** Students will be able to solve problems using a broad range of significant mathematical techniques, including calculus, algebra, geometry, analysis, numerical methods, differential equations, probability and statistics along with hands-on learning through CAS, LaTeX.
	PSO-2: Combine the principles of physics and chemistry, as supported by mathematics to describe the foundational concepts of the physical world and apply these concepts to new situations.
	PSO-3: Apply the techniques of mathematics to understand experimental observations and predict outcomes.
	PSO-4: Collaborate with others, including multidisciplinary groups, to solve scientific problems, and to recognize ethical issues in each respective profession.
	PSO-5: Students will be enabled to communicate mathematics effectively by written, computational and graphic means.
	PSO-6: Students will be enabled to create mathematical ideas from basic axioms.
	PSO-7: Students will learn to utilize mathematics to solve theoretical and applied problems by critical understanding, analysis and synthesis.
	PSO-8: Students will identify applications of mathematics in other disciplines and in the real-world, leading to enhancement of career prospects in a plethora of fields and research.
	PSO-9: Course will empower the students with the skills and together with the liberty of exploring their interests within the main subject.
	PSO-10: Students will be capable to use ICT tools in solving problems or gaining knowledge and to use appropriate softwares and programming skills to solve problems in mathematics.
	PSO-11: Students will acquire knowledge and skills through self- learning that helps in personal development and skill development for changing

	demands of work place.
	PSO-12: Students develop the ability to think critically, logically and analytically and hence use mathematical reasoning in everyday life.
	PSO-13: Students will be equipped with knowledge of basic concepts and ideas in mathematics and its subfields and will be able to apply the applications of the subject to other disciplines.
	PSO-14: It would also help in making responsible citizens and facilitate character building.

Course Outcomes

Semester 1

Course Name	Learning Outcomes	Programme Specefic Outcomes are Attained by
Paper1: Topics in Calculus	The primary objective of this course is to: • Introduce the basic tools of calculus which are helpful in understanding their applications in many real-world problems. • Understand/create various mathematical models in everyday life.	This course will enable the students to: • Understand continuity and differentiability in terms of limits and graphs of certain functions. • Describe asymptotic behaviour in terms of limits involving infinity. • Use of derivatives to explore the behaviour of a given function locating and classify its extrema and graphing the function. • Apply the concepts of asymptotes, and inflexion points in tracing of cartesian curves. • Compute the reduction formulae of standard transcendental functions with applications.

Semester 2

Course Name	Learning Outcomes	Programme Specific Outcomes are Attained by
Paper 2: Calculus and Geometry	• Define and use fundamental concepts of calculus including limits, continuity, differentiability and uniform continuity. • Sketch curves in a plane using its mathematical properties in the different coordinate systems of reference. • Use integration to find length, area and volume of surface of revolution.	• Students got familiarized with fundamental concepts of calculus. • Students are well-versed with conics and quadric surfaces so that they should able to relate the shape of real-life objects with the curves/conics.

GE2: Linear Algebra	• Learn about vectors and vector spaces. • Concept of basis and dimension of vector space will be clear. • Study of linear transformation is done	• Students learn about vector spaces and their real life applications
GE2: Discrete mathematics	• Basic principles of logic, set theory, Boolean algebra is introduced • Understand the ideas of mathematical induction and basic counting techniques	• Students construct logical arguments and rigorous proofs

Semester 3

Course Name	Learning Outcomes	Programme Specific Outcomes are Attained by
Paper 3: Abstract Algebra	• Recognize the mathematical objects that are groups, and classify them as abelian, cyclic and permutation groups etc. • Explain the significance of the notion of cosets, normal subgroups, and factor groups. • Understand the fundamental concepts of rings, fields and integral domains. Know about vector spaces over a field, and linear transformations.	• Students learn about the fundamentals of algebraic structures. • Learn the applications of vector spaces into real life problems
SEC 2: Computer Algebra System and Related softwares	• Use of computer algebra systems (Mathematica/MATLAB/ Maxima/ Maple etc.) as a calculator, for plotting functions and animations. • Use of CAS for various applications of matrices such as solving system of equations and finding eigenvalues and eigenvectors. • Understand the use of the statistical software R as calculator and learn to read and get data into R. • Learn the use of R in summary calculation, pictorial representation of data and exploring relationship between data. • Analyze, test, and interpret technical arguments on the basis of geometry.	• Students are able to use different computer algebra systems and are able to solve mathematical problems using them.

GE 3: Differential equation	• Solve the exact, linear and Bernoulli equations and find orthogonal trajectories. • Apply the method of variation of parameters to solve linear differential equations. • Formulate and solve various types of first and second order partial differential equations.	• The students get introduced to differential equations. • Different methods were discussed to solve differential equations.
GE 3: Linear programming and game theory	• Learn about the simplex method used to find optimal solutions of linear optimization problems subject to certain constraints. • Write the dual of a linear programming problem. • Solve the transportation and assignment problems. • Learn about the solution of rectangular games using graphical method and using the solution of a pair of associated prima-dual linear programming problems.	• Students are able to construct a linear programming problem for a given situation. • Simplex method helps them to get the optimal value of the problem • Transportation problem and assignment problems are learned by them and they are able to apply them to day-to-day life. • Students learn to solve two-person-zero-sum game using different methods.

Semester 4

Course Name	Learning Outcomes	Programme Specefic Outcomes are Attained by
Paper 4: Real Analysis	• Be familiar with the concept of countable and uncountable set, cluster points, Bolzano Weierstrass' theorem. • Recognize convergent, divergent, bounded, Cauchy and monotone sequences. • Test the convergence and divergence of series using ratio test, root test and Leibnitz test. • Understand the concepts of pointwise and uniform convergence. • Understand Riemann integrability o f c o n t i n u o u s a n d monotone functions.	• Students get a deep understanding of real line $\mathbb{R}$ • Students will be able to discuss convergence and divergence of sequences and series of real numbers. • Applications of integrable functions also learned
SEC 1: Mathematical Typesetting: LaTeX	• Create and typeset a LaTeX document. • Typeset a mathematical document using LaTex. • Learn about pictures and graphics in LaTex. • Create beamer presentations.	• Students were able to typeset mathematical equations • They were equipped with skill of making presentations involving long mathematical equations, a number of symbols.
GE4: Numerical methods	• Find the consequences of finite precision and the inherent limits of	• Important topics of numerical methods are understood by students

	numerical methods.	
	• Appropriate numerical methods to solve algebraic and transcendental equations.	
	• Solve first order initial value problems of ODE's numerically using Euler methods.	
GE 4: Elements of analysis	• Understand the real numbers and their basic properties.	• Students get an insight of real number system.
	• Be familiar with convergent and Cauchy sequences.	• They learned real sequences and series and their sums.
	• Test the convergence and divergence of infinite series of real numbers.	
	• Learn about power series expansion of some elementary functions.	

Semester 5

Course Name	Learning Outcomes	Programme Specefic Outcomes are Attained by
DSE 1: Mechanics and Discrete Mathematics	• Learn about friction, centre of gravity, work and potential energy in statics. • Know about various topics in dynamics such as simple harmonic motion, simple pendulum and projectile motion. • Know about various types of graphs such as complete and bipartite graphs. • Understand graphs, their types and its applications in study of shortest path algorithms.	• The students get introduced to differential equations. • Different methods were discussed to solve differential equations. • Students get insight of partial differential equations and their applications in real world.
SEC 3: Transportation and network flow	• Transportation, Assignment and Traveling salesperson problems. • Network models and various network flow problems.	• Students learn the applications of linear programming to solve real-life problems such as transportation problem, assignment problem, shortest- path problem, minimum spanning tree problem, maximum flow problem and minimum cost flow problem.

Semester 6

Course Name	Learning Outcomes	Programme Specefic Outcomes are Attained by
DSE2 : Probability and Statistics	This course will enable the students to learn: • Basic probability axioms and familiar with discrete and continuous random variables. • To measure the scale of association between two variables, and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression. • Central limit theorem, which helps to understand the remarkable fact that: the empirical frequencies of so many natural populations, exhibit a bell-shaped curve. fact that: the empirical frequencies of so many natural populations, exhibit a bell-shaped curve.	• Students are equipped with the concepts of probability and statistics
SEC4: Statistical Software: R	• This course will enable the students to: Use R as a calculator. • Read and import data in R. Explore and describe data in R and plot various graphs in R.	• Students learn the statistical software R and its use in real life