Programme Outcomes (PO), Programme Specific Outcomes (PSO), and Course Outcomes (CO) of B.A./B.Sc. (General) Programme in Mathematics

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Programme Outcomes (PO):

Programme outcomes (PO)	Description
Critical thinking	• By reflecting on their ideas and looking for alternative solutions, students can find ways to overcome obstacles. • As part of the program, students will gain proficiency in both Pure and Applied Mathematics as well as other basic sciences, including Physics, Chemistry, Computer Science, and other disciplines that focus on science.
Life-long learning	• Assist the student in analyzing problems, formulating hypotheses, evaluating and validating results, and drawing reasonable conclusions. • Provide students with the knowledge and skills needed to pursue research or careers in industry in the mathematical sciences or related fields.
Effective communication	• Throughout our modern society, mathematics plays a key role. Through effective oral and written communication skills, students will be able to express their ideas and thoughts mathematically clearly and concisely to others.
Social interaction	• A student should be able to relate mathematics to the real world.
Ethics	• In order for students to succeed in their higher education and professional careers, they must understand professional and ethical responsibility.
Environment and sustainability	• In the fields of space science, earth sciences, healthcare, and environmental protection, mathematics plays a vital role in finding sustainable solutions.

Programme Specific Outcomes (PSO):

- Develop abstract mathematical thinking.
- Understand the fundamental axioms in mathematics.
- Capable of developing ideas based on them.
- Inculcate mathematical reasoning.
- Adapt to complex mathematical arguments and ideas.
- Introduce students to suitable mathematical analysis tools so that they can handle issues and problems related to mathematics and related sciences.
- Develop the ability to solve specific theoretical and applied problems in advanced mathematics and statistics.
- Students will gain the necessary knowledge and skills to pursue further studies in mathematics and related areas across multiple disciplines.
- Educate students on the importance of developing a range of generic skills that will be useful for employment, internships, and social activities.

Course Outcomes (CO):

SEMESTER - I

COURSE TYPE	COURSE CODE	COURSE NAME	COURSE OUTCOMES
CORE COURSE (CC)	BMG1CC1A	Differential Calculus	The mentioned course will enable the student to • Find higher-order derivatives. • Apply the Leibnitz rule in solving higher-order derivatives related problems. • Solve various limit problems using L' Hospital's rule. • Understand the consequences of various mean value theorems. • Find the curvature, envelopes, and rectilinear asymptotes of different curves using the concept and principles of differential calculus. • Trace standard conics in both Cartesian and Polar coordinates. • Find the maxima and minima of functions. • Understand the wide application of differential calculus in economic, business, and life sciences. • Sketch the parametric curves such as Trochoid, cycloid, epicycloids, and hypocycloid. • Plot the graphs of functions like e^{ax+b}, log(ax+b), 1/(ax+b), sin(ax+b), cos(ax+b), |ax+b| and illustrate the effect of a and b on the graphs.

SEMESTER - II

COURSE TYPE	COURSE CODE	COURSE NAME	COURSE OUTCOMES
CORE COURSE (CC)	BMG2CC1B	Differential Equations	The mentioned course will enable the student to • Learn various techniques for getting solutions to first and higher order differential equations. • Know Picard's method of obtaining successive approximations of solutions of first order ordinary differential equations. • Understand the system of linear differential equations with the solution techniques. • Construct mathematical models using differential equations to achieve possible solutions to the problems connected to physical, chemical and biological disciplines. • Learn integrating factor, singular solution, and Clairaut's equation with solution process. • Know linear and non-linear partial differential equations. • Learn Lagrange's and Charpit's method for finding solution of partial differential equations. • Understand how to classify second order partial differential equations into elliptic, parabolic, and hyperbolic.

SEMESTER - III

COURSE TYPE	COURSE CODE	COURSE NAME	COURSE OUTCOMES
CORE COURSE (CC)	BMG3CC1C	Real Analysis	The mentioned course will enable the student to • Understand countable, uncountable sets, completeness property and Archimedean property of **R**. • Define and recognise the supremum and infimum of bounded set, the limit point and interior point of a set. • Learn the Bolzano-Weierstrass theorem for the existence of limit points. • Recognize bounded, convergent, divergent, Cauchy and monotonic sequences. • Find limit superior, limit inferior, and the limit of a bounded sequence. • Prove squeeze theorem, Cauchy's first and second limit theorems. • Define sub-sequences, Bolzano-Weierstrass theorem, limit superior, limit inferior of bounded sequence. • Verify that a series of positive terms is convergent or divergent by using different test such as comparison test, D'Alembert's Ratio test, Cauchy's root test, Raabe's test, Logarithmic test, De Morgan's and Bertrand's test, Kummer's test, and Gauss's test. • Know alternating series, conditional and absolute convergence of series. Apply the Leibnitz's theorem to check convergence of alternating series. • Understand pointwise and uniform convergence of sequence of functions. Also know various facts related to continuity, integrability, and derivability of pointwise and uniform convergence sequences. • Learn about various tests for uniform convergence of series including Weierstrass's M-test, Abel's test, and Dirichlet's test. • Define and calculate the radius of convergence of power series
SKILL ENHANCEMENT COURSE (SEC)	BMG3SEC13	Integral Calculus	The mentioned course will enable the student to • Evaluate the definite integrals. • Explain different properties of definite integrals. • Solve integration of rational and irrational functions. • Understand the reduction formulae for integrals of rational, trigonometric, exponential, and logarithmic functions. • Gain working knowledge of double and triple integrals. • Evaluate volume and surface areas of solids of revolution.

SEMESTER - IV

COURSE TYPE	COURSE CODE	COURSE NAME	COURSE OUTCOMES
CORE COURSE (CC)	BMG4CC1D	Algebra	The mentioned course will enable the student to • Recognize the mathematical objects called groups. • Define abelian and non-abelian groups, Z_n group, U(n) group, cyclic group, linear group $GL_n(n,R)$. • Link the fundamental concepts of groups and symmetries of geometrical objects. • Explain the significance of the notions of cosets, normal subgroups, and factor groups. • Analyze consequences of Lagrange's theorem. • Learn about structure preserving maps between groups and their consequences. • Know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields. • Know the fundamental concepts in ring theory such as the concepts of ideals, quotient rings, integral domains, and fields. • Learn in detail about polynomial rings, fundamental properties of finite field extensions, and classification of finite fields.
SKILL ENHANCEMENT COURSE (SEC)	BMG4SEC22	Theory of Equations	The mentioned course will enable the student to • Understand properties of polynomials, maximum and minimum values of polynomials. • Apply the Descarte's rule of signs to find number of positive and negative real roots of polynomials. • Describe the relation between roots and coefficients. • Find the sum of the power of the roots of an equation using Newton's Method. • Transform the equation through roots multiplied by a given number, increase the roots, and decrease the roots, removal of terms. • Solve the reciprocal and binomial equations. • Know the algebraic solutions of cubic and biquadratic equations. • Learn the properties of derived functions. • Analyse the location and describe the nature of the roots of an equation.

SEMESTER - V

COURSE TYPE	COURSE CODE	COURSE NAME	COURSE OUTCOMES
DISCIPLINE SPECIFIC ELECTIVES (DSE)	BMG5DSE1A3	Linear Algebra	The mentioned course will enable the student to • Understand the vector spaces, subspaces, bases, dimension and their properties. • Derive the basis and dimension of a vector space, and understand the change of basis. • Discuss the rank and nullity of linear transformations. • Compute eigen values and eigen vectors kernel and range of linear transformation and find matrices of general linear transformations. • Prove Cayley- Hamilton theorem, Schwartz inequality, Gramschmidt orthogonalisation process. • Solve the system of simultaneous linear equations • Learn linear independence and dependence. • Compute eigenvalues and eigenvectors of a matrix of linear transformation. • Realise importance of Jordan canonical form of linear transformation and computation procedure.
SKILL ENHANCEMENT COURSE (SEC)	BMG5SEC31	Probability and Statistics	The mentioned course will enable the student to • Understand probability, conditional probability. • Know Baye's theorem and its application. • Define probability density function, probability distribution. • Derive mathematical expectation, binomial, poisson, normal distribution. • Understand distributions in the study of the joint behaviour of two random variables. • Discuss Moments Skewness and Kurtosis. • Learn central limit theorem. • Solve the problems of large samples and small samples. • Understand the moment generating functions, chi-square distribution. • Compute the analysis of variance, one way and two way classifications, Latin square design.

SEMESTER - VI

COURSE TYPE	COURSE CODE	COURSE NAME	COURSE OUTCOMES
DISCIPLINE SPECIFIC ELECTIVES (DSE)	BMG6DSE1B3	Linear Programming	The mentioned course will enable the student to • Analyze and solve linear programming models of real life situations. • Provide graphical solutions of linear programming problems with two variables, and illustrate the concept of convex set and extreme points. • Understand the theory of the simplex method. • Learn two-phase method, Big-M method and their comparison. • Know about the relationships between the primal and dual problems, and to understand sensitivity analysis. • Learn about the applications to transportation, assignment and two-person zero-sum game problems.
SKILL ENHANCEMENT COURSE (SEC)	BMG6SEC42	Transportation and Game Theory	The mentioned course will enable the student to • Express Transportation problem in mathematical form. • Apply northwest-corner, least cost, Vogel approximation methods to determine solutions. • Understand to know algorithm for solving transportation problem. • Know the Assignment problem and its mathematical formulation. • Apply Hungarian method to solve assignment problem. • Define Game theory, and games with mixed strategies. • Determine the solution of two persons zero sum games. • Describe a detail procedure to solve game through graphical method.