

GDC Memorial College, Bahal (Bhiwani)

NAAC Accredited Grade 'B'

Department of Mathematics B.A.

Course Outcomes, Programme Outcomes and Programme Specific Outcomes

➤ **Programme Outcomes(PO)**

After successful completion of the three year degree program in science a student should be able to:

- PO1: Apply the underlying unifying structures of mathematics (i.e. sets, relations and functions, logical structure) and the relationships among them.
- PO2: Demonstrate proficiency in writing proofs
- PO3: 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
- PO4: Classes develop student abilities and aptitudes to apply mathematical methods and ideas not only to problems in mathematics and related fields such as the sciences, computer science, actuarial science, or statistics, but also to virtually any area of inquiry.
- PO5: mathematics degree programs is to equip students with analytic and problem solving skills for careers and graduate work.
- PO6: Demonstrate basic manipulative skills in algebra, geometry, trigonometry, and beginning calculus.
- PO7: Communicate effectively through soft skills, report writing, documentation and effective presentations.
- PO8: Perform as an individual and as a member or leader in diverse teams in multidisciplinary settings.
- PO9: develop an understanding of the underlying unifying structures of mathematics (i.e., sets, relations and functions, logical structure) and the relationships among them.
- PO10: Students learn to communicate ideas effectively and to digest new information and concepts independently. Students are encouraged to develop intellectually and to become involved with professional organizations.
- PO11: develop the ability to read and learn mathematics on their own. Such maturity is a much a function of how mathematics is learned as it is of what mathematics is learned.

➤ **Program Specific Outcomes(PSO)**

Students will be able to

- PSO1: Student is equipped with mathematical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- PSO2: Student should be able to apply their skills and knowledge that is translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion
- PSO3: Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study

- PSO4: Think in a critical manner. Familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
- PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied problems in advanced areas of mathematics and statistics.
- PSO6: Provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.
- PSO7: student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.
- PSO8: A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology.
- PSO9: A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.

➤ **Course Outcomes (CO):**

B.A-(Maths): Sem-1st Subject: Algebra Subject code: BM 111

- CO1: Work with matrices and determine if a given square matrix is invertible.
- CO2: Learn to solve systems of linear equations and application problems requiring them.
- CO3: Learn to compute determinants and know their properties.
- CO4: Learn to find and use eigenvalues and eigenvectors of a matrix.
- CO5: Learn about and work with vector spaces and subspaces.
- CO6: Find the inverse of a square matrix. Solve the matrix equation $Ax = b$ using row operations and matrix operations. Find the determinant of a product of square matrices, of the transpose of a square matrix, and of the inverse of an invertible matrix
- CO7: Determine if a given matrix is diagonalizable.

2 Subject: Calculus Subject code: BM112

- CO1: understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
- CO2: locate the x and y intercepts, any undefined points, and any asymptotes.
- CO3: determine asymptotes for rational expressions. apply the techniques from the previous section to graph a fourth degree polynomial or higher

- CO4: determine if there is any symmetry to aid in the graphing process.
- CO5: determine the point(s) of intersection of pairs of curves.

3 Subject: Solid Geometry Subject Code: BM113

- CO1: get basic knowledge about Circle, Cone, Parabola, Hyperbola, Ellipse etc.
- CO2: To understand the concepts & advance topics related to two & three dimensional geometry.
- CO3: To study the applications of conics.
- CO4: To study the application of Sphere, cone and cylinder.
- CO5: To study how to trace the curve.

B.A (Maths)-Sem:2nd

1 Subject: Number Theory and Trigonometry

Subject Code: BM121

- CO1: Demonstrate knowledge and understanding of topics including, but not limited to divisibility, prime numbers, congruences, quadratic reciprocity, Diophantine equations.
- CO2: Learn methods and techniques used in number theory. Write programs/functions to compute number theoretic functions.
- CO3: Use mathematical induction and other types of proof writing techniques. Evaluate trigonometric and inverse trigonometric functions.
- CO4: Solve trigonometric equations and applications.
- CO5: Apply and prove trigonometric identities.

2 Subject: Ordinary Differential Equations

Subject Code: BM122

- CO1: Student will be able to solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous, or Bernoulli cases.
- CO2: Student will be able to find the complete solution of a nonhomogeneous differential equation as a linear combination of the complementary function and a particular solution.
- CO3: Student will be introduced to the complete solution of a nonhomogeneous differential equation with constant coefficients by the method of undetermined coefficients.

- CO4: Student will be able to find the complete solution of a differential equation with constant coefficients by variation of parameters.
- CO5: Student will have a working knowledge of basic application problems described by second order linear differential equations with constant coefficients.

3 Subject:Vector Calculus.

Subject Code:BM123

- CO1: Memorize definition of directional derivative and gradient meaning with sketches.
- CO2: Memorize theorem relating directional derivative to gradient and reproduce proof.
- CO3: Calculate directional derivatives and gradients.
- CO4: Apply gradient to solve problems involving normal vectors to level surfaces.
- CO5: Explain the concept of a vector integration a plane and in space.

B.A (Maths)-Sem:3rd

1 Subject:Advanced calculusSubject code:BM231

- CO1: To study functions and several variables.
- CO2: To study the notion of Continuity and Differentiability of multivariate functions.
- CO3: To find extreme values of multivariable functions using derivatives.
- CO4: To study about the indeterminate forms of limit.
- CO5: To understand the behavior of curves in space and also find their curvature and torsion.

2Subject: Partial Differential Equations Subject code: BM 232

- CO1:classify partial differential equations and transform into canonical form
- CO2: solve linear partial differential equations of both first and second order
- CO3: apply partial derivative equation techniques to predict the behaviour of certain phenomena.
- CO4: apply specific methodologies, techniques and resources to conduct research and produce innovative results in the area of specialization.
- CO5: extract information from partial derivative models in order to interpret reality.
- CO6: identify real phenomena as models of partial derivative equations.

3 Subject:Statics

Subject code: BM 233

- CO1: An ability to construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium.
- CO2: An understanding of the analysis of distributed loads.
- CO3: knowledge of internal forces and moments in members.
- CO4:An ability to calculate centroids and moments of inertia.
- CO5: Learn about the concept of friction, Wrench, Null lines etc.

B.A (Maths)-4thSem

1 Subject: Sequence and series. Subject code:BM241

- CO1: Determine if an infinite sequence is bounded.
- CO2: if an infinite sequence is monotonic.
- CO3: Determine if an infinite sequence is convergent or divergent.
- CO4: Find the sequence of partial sums of an infinite series.
- CO5: Determine if a geometric series is convergent or divergent.
- CO6: Find the sum of a convergent geometric series.
- CO7:Determine if an infinite series is convergent or divergent by selecting the appropriate test from the following: (a) test for divergence; (b) integral test; (c) p-series test; (d) the comparison tests; (e) alternating series test; (f) absolute convergence test; (g) ratio test and (h) root test.
- CO8: Determine if an infinite series converges absolutely or conditionally.

2 Subject:Special function and integral transformSubject code:BM242

- CO1: understand integral calculus and special functions of various engineering problem and to know the application of some basic mathematical methods via all these special functions.
- CO2: explain the applications and the usefulness of these special functions.
- CO3: classify and explain the functions of different types of differential equations.
- CO4: understand purpose and functions of the gamma and beta functions, Fourier series and Transformation.
- CO5: use the gamma function, beta function and special functions to: evaluate different types of integral calculus problems and Fourier series to solve differential equations.
- CO6: analyze properties of special functions by their integral representations and symmetries.
- CO7: To determine properties of Fourier Transform this may be solved by application of special functions.

- CO8: To determine properties of Laplace Transform this may be solved by application of special functions. To determine properties of Legendre Polynomial this may be solved by application of special functions.

3 Subject: Programming in C and Numerical Methods. Subject code:BM 243

- CO1:Read, understand and trace the execution of programs written in C language.
- CO2: Write the C code for a given algorithm.
- CO3: Write programs that perform operations using derived data types.
- CO4: Solve an algebraic or transcendental equation using an appropriate numerical method.
- CO5:Solve a linear system of equations using an appropriate numerical method.
- CO6:Perform an error analysis for a given numerical method.

B.A (Maths)-Sem:5th

1 Subject: Numerical Analysis SubjectCode: BM 363

- CO1: Define Basic concepts of operators ,Find the difference of polynomialSolve problems using Newton forward formula and Newton backward formula.
- CO2:Derive Gauss's formula and Stirling formula using Newton forward formula
- CO3: Find maxima and minimafor differential difference equation .
- CO4: Derive Simpson's $1/3$, $3/8$ rules using trapezoidal rule.
- CO5: Find the solution of the first order and second order equation with constant Coefficient. Find the summation of series finite difference techniques
- CO6:Find the solution of ordinary differential equation of first by Euler, Taylor and Runge-Kutta methods
- CO7: To find Expectation (mean and variance), Moment Generating Function of discrete and uniform distributions.

2 Subject: Groups And Rings Subject Code:BM352

- CO1: To introduce the concepts Groups, Permutation groups, Direct product of group. Define subgroup, center, Normalizer of a subgroup.
- CO2: Find cycles and transpositions of a given permutations. Prove Lagrange's Theorem

- CO3: Define cyclic groups Prove a group has no proper subgroup if it is cyclic group
- CO4: Define normal subgroups , quotient groups and index of a subgroup. Define homomorphism ,kernel of a homomorphism, isomorphism.
- CO5: Prove Cayley's theorem , the fundamental theorem of homomorphism for Groups .Define rings , zero divisors of a ring , integral domain.

3 Subject: Real analysis Subject Code: BM351

After successful completion of the course, the student is expected to:

- CO1: Explain Continuity and Discontinuity of various functions in different contexts. Differentiate Uniform continuity from continuity and related theorems
- CO2: Understand theorems associated with differentiability. Gain knowledge of L' Hospital Rule and evaluation of limits. Expand functions using Taylor Series
- CO3: Understand partitions and their refinement. Understand Integrability and theorems on integrability. Acquire the idea about Riemann Integrability and Riemann Integration
- CO4: Understand various theorems associated with Riemann Integration. Develop and prove a selection of theorems concerning integration. Explain convergence of a series.
- CO5: Develop skill in checking the uniform convergence of series using various tests of convergence. Distinguish between Pointwise convergence and Uniform Convergence.
- CO6: Illustrate the convergence properties of power series CO18: Illustrate the effect of uniform convergence on the limit function with respect to continuity.

B.A(Maths)-Sem:6th

1 Subject: linear algebra Subject Code: BM362

After successful completion of the course, the student is expected to:

- CO1 Acquire the knowledge of a matrix, basic operations, rank and determinant of a matrix.
- CO2: Understand the various applications of the theory of matrices to a wide variety of problems.
- CO3: Understand various methods for determining rank of a matrix. Acquire knowledge of invertible matrices and their properties. Recognize the concepts of the terms span, linear independence, basis, dimension, and apply these concepts to various vector spaces and subspaces.
- CO4 Introduce the new terms Basis and Dimension. Acquire the knowledge of ordered basis. Analyze vectors in R geometrically and algebraically. Analyze finite and infinite dimensional vector spaces and subspaces over a field and their properties, including the basis structure of vector space.

- CO5 Solve a System of Linear equations using the inverse of a matrix. Distinguish between consistent and inconsistent system of equations. Use matrix algebra and the relate matrices to linear transformations.
- CO6 Understand the concept of linear transformations and their properties. Use the definition and properties of linear transformations and matrices of linear transformations and change of basis, including kernel, range and isomorphism. Familiarize with transition matrices.
- CO7 :Determine the Kernel of linear transformations and nullity of associated vector spaces. Compute with the characteristic polynomial and equation of a given square matrix. Familiarize characteristic roots and characteristic vectors

2 Subject: Dynamics

Subject Code: BM353

After successful completion of the course, the student is expected to:

- CO1: Define Projectile, impulse, impact and laws of impact.
- CO2: Prove that the path of a projectile is a parabola.
- CO3: Find the direct and oblique impact of smooth elastic spheres.
- CO4: Define Simple Harmonic Motion and find its Geometrical representation.
- CO5: Find the Composition of Simple Harmonic Motion and the differential equation of a central orbit. • Find the law of force if the orbit is given and vice versa.

3 Subject: Real and Complex Analysis

Subject Code: BM361

- CO1: Prove some inequalities by using $AM > GM$. State and Prove Weirstrass, Schwartz's inequality. Course Outcome of Complex Analysis Students will able to
- CO2: Compute sums, products, quotients, conjugate, modulus, and argument of complex numbers. Calculate exponentials and integral powers of complex numbers.
- CO3 :equation of straight line, circle in complex form .Define reflection points, inverse points
- CO4: Understand the significance of differentiability for complex functions and be familiar with the Cauchy-Riemann equations.
- CO5: Determine whether a given function is analytic. •Define bilinear transformation, cross ratio, fixed point. •Write the bilinear transformation which maps real line to real line, unit circle to unit circle, real line to unit circle.
- CO6: Find parameterizations of curves, and compute complex line integrals directly. Use Cauchy's integral theorem and formula to compute line integrals. Represent functions as Taylor, power and Laurent series. Classify singularities and poles.