

**Shivraj College of Arts, Commerce and D.S.Kadam Science College,  
Gadhinglaj  
Program Specific Outcomes  
and  
Course Outcomes**

**Program : B.Sc. Mathematics  
Number of Semesters : 06**

---

---

**Program Specific Outcomes**

1. Students gain a sound knowledge in foundational subjects related to pure and applied mathematics.
  2. Acquire various skills related to computational techniques and related softwares.
  3. Learn to identify various areas of science , technology , industry etc. where the knowledge and skill imparted to them can be useful.
  4. To be able to select a specific problem from real life scenario as per liking of a student and his/her skill sets and knowledge.
  5. Being able to analyze the problem and propose a solution method and finalise the solution and the process of solution in consultation with the peer group and faculty.
- 

**Course Outcomes**

**B.Sc. Part -I**

**Semester – I**

**Theory paper : V.A Differential Calculus**

- 1) Students acquaint themselves with the idea of complex numbers.
- 2) Learn algebraic and geometric properties of complex numbers.
- 3) Understand Meaning and significance of Hyperbolic functions and their relation with circular functions
- 4) Learn the process of successive differentiation of standard functions.
- 5) Get to know the significance of Leibnitz's theorem.
- 6) Understand the concept of partial differentiation and learn to apply it for various problems in science and engineering .

**Theory paper : VI.A Calculus**

1. Students grasp the concept of mean value theorems and its significance.
2. Acquire the skill of applying Taylor's theorem for computation of power series expansions of functions.
3. Study the special case of Taylor's expansion viz. Maclaurin Series and its practical use in computing values of standard transcendental functions.
4. Learn the meaning and significance of Indeterminate forms and learn to apply it for various indeterminate limiting cases.

---

**B.Sc. Part -I**  
**Semester – II**

**Theory paper : V.B    Differential Equations**

1. Understand the meaning , motivation and significance of differential equations.
2. Learn the classification of differential equations .
3. Concept of order and degree is studied with examples.
4. Learn how to form and solve first order first degree ordinary differential equations.
5. Learn the methods of solving equations of first order and higher degree.
6. Getting acquainted with operator formalism. Solving higher order ordinary linear linear differential equations.
7. Study the homogeneous linear differential equations with constan coefficients and learn the method of solution.

**Theory paper : VI.B    Higher order Ordinary Differential Equations and Partial Differential equations.**

1. Study the method of solution of general second order differential equation with variable coefficients.
  2. Understand the concept , formation , and method of solution of ordinary simultaneous equations.
  3. Understand the concept of total differential equation , learn the method of formation and method of solution of total differential equations.
  4. Study the motivation and concept of partial differential equations. Learn methods of solving Lagrange's equation and Charpit's method.
-

**B.Sc. Part -I**  
**Semester – I and II ( Combined )**

**Practical : CML-I ( Computational Mathematics Laboratory – I )**

1. Students get acquainted with the field of numerical computational methods and various areas covered within the subject of numerical computations with a bird's eye view of applications.
  2. Learn to use electronic calculators and computers for simple calculations of algebraic and transcendental functions that are frequently required in science and technology.
  3. To carry out supervised learning of problem solving based on theory covered in theory papers .
  4. Teacher gets to know student specific queries / difficulties and helps students solve their individual problems with personal attention.
- 

**B.Sc. Part -II**

**Semester -III**

**Theory Paper : V . C Real Analysis – I**

1. Learning basic concepts of set theory .
2. To learn the concept of relation and function and apply it to specific problems.
3. Study the principle of mathematical induction and apply it for proving results.
4. Acquire the concept of countability and determine countable and uncountable sets.
5. Learn the fundamental properties of real numbers.

**Theory Paper : VI.C Algebra – I**

1. Understanding of the concept of Hermitian and Skew-Hermitian Matrix and their properties.
2. Grasp the concept of normal form and convert given matrix to Normal form.
3. Learn the concept of Eigen value and Eigen vector . To find Eigen values and Eigen vectors.
4. Grasp Cayley – Hamilton theorem and use it for finding inverse of a matrix.
5. Learn elements of group theory and be able to determine if given set with given operation is group or not.

## Semester -IV

### Theory Paper : 5D Real Analysis – II

1. Learn fundamental concept of sequence of real numbers with examples.
2. Study the concept of monotonic and bounded sequences.
3. Understand Epsilon-Delta concept of convergence of a sequence.
4. Learn the concept of series and its convergence.
5. Study the methods of testing convergence of series.

### Theory Paper : 6D Algebra – II

1. Understand the concept of Cosets.
  2. Learn the meaning of Normal subgroups of a group with examples.
  3. Study the concept of a Permutation group with examples.
  4. Learn the concept of a Ring structure with examples.
- 

## B.Sc. Part -II Semester – III and IV ( Combined )

### Practical : CML – II ( Computational Mathematics Laboratory – II )

1. Learn to solve linear systems of equations by Gauss-Elimination , Gauss-Jordan , Gauss-Jacobi and Gauss-Seidel methods manually with use of electronic calculators .
2. Learn root finding methods viz. Newton-Raphson method , Bisection method.
3. Learn methods for evaluating numerical values of integrations using trapezoidal rule , simpson's 1/3 rd rule , simpson's 3/8 th rule.
4. Learn to solve 1<sup>st</sup> order ODE with Euler's and modified Euler's method.

### Practical : CML – III ( Computational Mathematics Laboratory – III )

1. Learn the basic keywords of C programming language and practice them in computer lab.
2. Studying basic data types and input output methods in C and practice it in computer laboratory
3. Learn Basic constructs of C Language programming like comparison ,decision making , loop structures , system and user defined functions and practice based on it in computer laboratory .
4. Apply the knowledge of C programming for preparing C programs for the solution of various numerical methods learned in the paper CML-II

---

## **B.Sc. Part -III**

### **Semester -V**

#### **Theory Paper : Paper – IX ( Real Analysis )**

1. Learn the elements of sets , relations and functions .
2. Learn the properties of real numbers , algebra of intervals , infimum and supremum concept.
3. Study the concept of sequence , sub-sequence , convergence of a sequence and tests of convergence.
4. Study the concept of series and various tests of convergence of series.
5. To understand the concept of real valued functions of a single real variable and tests of limits , continuity and differentiability of functions.
6. Understanding and using the concept of improper integrals.

#### **Theory Paper : Paper – X ( Modern Algebra )**

1. Learn the elements of group theory with examples.
2. Learn the concepts homomorphism , automorphism , commutator element , Kernel of a group .
3. Study various types of groups like cyclic groups , permutation groups , normal subgroups , quotient groups.
4. Learn the concept of ring and examples of ring including a Boolean ring.

#### **Theory Paper : Paper – XI ( Partial Differential Equations )**

1. Study the classification of partial differential equations.
2. Learn the formation process of partial differential equations.
3. Study the method of solving Lagrange's partial differential equation and apply it to solve problems.
4. Study the Charpit's method and apply it to solve the problems.
5. Learn the method of solution of homogeneous partial differential equations and apply it to solve problems.

#### **Theory Paper : Paper – XII ( Numerical Methods – I )**

1. Study and apply the methods of root finding viz. Newton Raphson method , Bisection method , Secant method , Regula falsi method .
  2. Study and apply methods of solving linear system of equations viz. Gauss-Elimination , Gauss-Jordan , Gauss-Jacobi and Gauss-Seidel method.
  3. Study and apply the methods of finding Eigen values and Eigen vectors.
-

## **B.Sc. Part -III**

### **Semester -VI**

#### **Theory Paper : Paper – XIII ( Metric Spaces )**

1. Understanding the concept of a metric on non-empty set and its properties with examples.
2. Grasping the concept of "closeness" and limit in terms of a given metric .
3. Limit of a function in terms of a metric space.
4. Understanding and applying concept of connectedness , completeness and compactness.
5. To study the properties of continuous functions in the sense of metric spaces.

#### **Theory Paper : Paper – XIV ( Linear Algebra )**

1. To grasp the concept of a vector space with examples . Understand subspaces , homomorphism , span , basis , dimension , linear dependence and independence .
2. Study the linear transformations. Rank and nullity concepts , Matrix of transformation.
3. Study inner product of vectors , Cauchy-Schwartz , Triangle and parallelogram inequalities.
4. To learn the concept of Eigen – values and Eigen vector in view of vector spaces and solve examples based on it.

#### **Theory Paper : Paper – XV ( Complex Analysis )**

1. Understand the concept of complex variable and a complex valued function .
2. Learning the significance and applications of harmonic functions.
3. Know the meaning of analytic function and Cauchy-Riemann equations.
4. To derive Cauchy's integral formula for simply and multiply connected domains.
5. To study the development of Laurent series and expansion of functions.
6. Learn about zeros and poles , calculation of residues.
7. Imbibe the concept of Entire and Meromorphic functions.

#### **Theory Paper : Paper – XVI ( Numerical Methods – II )**

1. Understand the meaning of interpolation . Learn the methods of interpolation for equal and unequal intervals.
  2. Study and apply the concept of numerical differentiation and to be able to solve the problems of differentiation.
  3. Learn the methods of solving ordinary differential equations and apply them to given problems.
-

## **B.Sc. Part -III**

### **Semester – V and VI ( Combined )**

#### **Practical Paper : Paper CML-IV ( Operations Research )**

1. To understand the linear programming problem and learn various methods for solving these problems.
2. Learn the nature of transportation problems and solve the examples.
3. Learn the nature of assignment problems and solve the practical problems.
4. Understand the concept of Game theory , its significance and applications to modern industrial engineering , military applications , logistics and solve various problems.

#### **Practical Paper : Paper CML-V ( Numerical Methods )**

1. To apply the methods of solution for solving linear system of equations that are already studied in theory papers.
2. To apply methods of interpolation for various equally and unequally spaced intervals.
3. Practice the methods of numerical integration to actually evaluate various integrals.
4. Learn to use Runge-Kutta methods for solving first order ordinary methods.

#### **Practical Paper : Paper CML-VI ( Numerical Recipes in C++ and Scilab )**

1. Learn the skills of using various keywords , data types , expressions and input output in C++
2. Learn and apply decision and loop constructs in C++
3. Study and practice the concept of arrays , inbuilt and user defined functions.
4. Develop various programs to solve the problems using numerical methods and knowledge of C++ previously learned in 1,2,3 above.
5. Learn the basic data types and operations in Scilab.
6. To solve problems of computational mathematics using Scilab.
7. Grasp the idea of visualisation and graph plotting and apply it for plotting graphs of functions.

#### **Practical Paper : Paper CML-VI ( Project )**

1. To survey and identify various areas related to science , engineering , technology , industrial setups where the application of various skills and theories learned during the course of study can be useful to solve the problems.
2. To select a specific problem from above mentioned fields that is best suited for students knowledge base and aptitude.
3. To motivate students to figure out various solutions under the guidance of faculties and select one of the solutions and design appropriate methodology and plan for solution.
4. To encourage students to work out the solution under the guidance of the faculty . If necessary , develop computer programs for the same.
5. Present the solution in front of the peer group and faculties for discussion and constructive criticism and suggestions.
6. Help student make necessary modifications /changes in solution if required.