

**Gujarat University**  
**Choice Based Credit System (CBCS)**  
**Syllabus for Semester I (Mathematics)**  
**MAT 101: Calculus and Matrix Algebra(Theory)**

Hours: 4 /week

Credits: 4

**Unit: I**

Successive Derivatives, standard results for  $n^{\text{th}}$  derivative, Leibniz's Theorem. Definition of limit of a sequence, Convergence and divergence of an infinite series, Alternating Series (Without proof). Comparison test, Ratio test and Root test.

**Unit: II**

Rolle's Theorem, Lagrange's and Cauchy's Mean Value Theorems(MVT), Increasing and decreasing functions, Taylor's and Maclaurin's Theorems (both without proof). Using Taylor's and Maclaurin's Theorem find Maclaurin power series expansion of  $\sin x$ ,  $\cos x$ ,  $\log(1+x)$ ,  $e^x$ ,  $(1+x)^n$  under proper restrictions(if any). Indeterminate forms: all forms of L'Hôpital's Rules with proof and all forms.

**Unit: III**

Introduction to matrices, different types of matrices, operations on matrices, Theorems on matrices, Elementary operations on matrices and types of matrices, Symmetric and skew-symmetric matrices, Hermitian and skew-hermitian matrices. Linear dependence and independence of row and column matrices. Row rank, column rank and rank of a matrix. Row Reduced Echelon (RRE) form of a matrix and matrix inversion using it.

**Unit: IV**

Eigen values, Eigen vectors and the characteristic equation of a matrix. Cayley-Hamilton (CH) theorem and its use in finding inverse of a matrix. Application of matrices in solving a system of simultaneous linear equations. Cramer's rule. Theorems on consistency of a system of simultaneous linear equations.

**Reference Books:**

1. Calculus and Analytic Geometry – G. B. Thomas and R. L. Finney. Pearson Education. Indian Reprint.
2. Calculus – James Stewart, Sixth edition, (E-Book).
3. Calculus – T. M. Apostol. Volume I.
4. Differential Calculus – Shanti Narayan, P.K. Mittal, S. Chand and Co.
5. Differential Calculus – Harikishan, Atlantic Publishers.
6. Calculus – M. Spivak.
7. An Introduction to Linear Algebra – I. K. Rana, Ane Books Pvt. Ltd.
8. Linear Algebra Theory and Applications – Ward Cheney, David Kincaid. Jones and Bartlet India Pvt. Ltd.
9. Introduction to Linear Algebra – Serge Lang. Springer (India).
10. Matrix and Linear Algebra – K. B. Dutta, Prentice Hall.
11. A Textbook of Matrices – Shanti Narayan, P K Mittal, S. Chand Group.
12. Introduction to Linear Algebra – V. Krishnamurthy, Affiliated East-west Press Pvt Ltd.

**Gujarat University**  
**Choice Based Credit System (CBCS)**  
**Syllabus for Semester I (Mathematics)**  
**MAT 102: Calculus and Matrix Algebra (Practical)**

Hours: 4/week  
Duration: 2hrs/practical

Credits: 3  
Number of practicals: 20

**Unit I:**

Practicals based on Integral and successive differentiation. (Practical Number 1- 6).

**Unit II:**

Practicals based on convergence of infinite series, Mean value theorems, Expansions of functions, and L'Hôpital's Rule. (Practical Number 7 - 12).

**Unit III:**

Practicals based on Matrices and its applications. (Practical Number 13 - 17).

**Unit IV:**

Practicals based on tracing of curves. (Practical Number 18 - 20)

**List of Practical:**

1. Find the limit of sums using the definite integral(5+5=10 problems)
2. Find the definite integrals using substitution (5+5=10 problems)
3. Find the definite integrals using integration by parts(5+5=10 problems)
4. Find the integral by method of partial fractions(5+5=10 problems)
5. Find the nth derivative of the following functions at the given points.
6. Applications of Leibniz theorem
7. Discuss Convergence of the infinite series-I
8. Discuss Convergence of the infinite series-II
9. Geometrical Interpretation of MVT. and verification of MVT
10. Problems on MVT.
11. Expansions of functions in infinite power series using Taylor and Maclaurin formulae
12. Evaluate limit using L'Hôpital's rule.
13. Find RRE form and rank of a matrix
14. Find inverse using Gauss Jordan method( using row operations)
15. Verify the Cayley-Hamilton(CH) theorem – inverse of matrix using it- problems on CH theorem.
16. Find Eigen values and Eigen vectors
17. Solution of system of linear equations using row operations and Cramer's rule.
18. Asymptotes of curves
19. Concavity and point of inflexion of a curve in  $R^2$ .
20. Graphs of Cartesian equations of some standard functions.

**Gujarat University**  
**Choice Based Credit System (CBCS)**  
**Semester-I**  
**Syllabus**

**EC 101: Mathematical basics and Quantitative skills**

**Hours: 3/ week**

**Credit 2**

**Unit-1. Trigonometry:**

Unit circle, trigonometric functions, values of trigonometric function at distinct points, relation among trigonometric functions, trigonometric formulae,  $\sin(x \pm y)$ ,  $\cos(x \pm y)$ ,  $\tan(x \pm y)$ ,  $\operatorname{sinc} \pm \operatorname{sind}$ ,  $\operatorname{cosc} \pm \operatorname{cosd}$ ,  $2\sin x \cos y$  ( and others), inverse of trigonometric functions.

**Unit-2. Co-ordinate Geometry and Vectors:**

Distance Formula, Section Formula, Equation of a line and its slope, intersection of two lines, Equation of a circle and its tangent, elementary vector algebra.

**Unit-3. Limit and Differentiation:**

Right hand limit, Left hand limit and limit of a function.  $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$ ,  $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ ,  $\lim_{h \rightarrow 0} \frac{a^h - 1}{h}$  and  $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$ , continuity, derivatives of  $x^n$ ,  $e^x$ ,  $\log x$ , trigonometric functions, inverse trigonometric functions, chain rule, geometric meaning of derivative.

**Unit-4. Integration:**

Integration of  $x^n$ ,  $e^x$ , trigonometric functions, well known functions like  $\frac{1}{x^2 \pm a^2}$ ,  $\frac{1}{\sqrt{x^2 \pm a^2}}$ ,  $\sqrt{x^2 \pm a^2}$ , Method of substitution, integration by parts, definite integral ( Up to Fundamental Theorem of Integral Calculus).

**N.B. All the results / formulae are without proof.**

**Books: (1)** Gujarat Rajya Pathya Pustak Mandal for std 11 and std 12.

**(2)** A Textbook for class XI & XII, National Council of Educational Research and Training.

**(3)** A Class Book of Mathematics for class XII by Chakrabarty S. K., Biswajit Bhagwati, S. Chand Publishers.

**(4)** Short Calculus by Serge Lang, Springer(India)