

Mathematics

Grade : XI

Full Marks: 100
Teaching hours: 150

I. Introduction:

This course deals with the fundamentals of advanced mathematical concepts. It also tries to consolidate the concepts and skills learnt in Mathematics course in school level. It is desirable at the end of each unit sufficient problems be solved.

II. Specific Objectives:

On completion of this course students will be able to:

1. use principles of elementary logic to find the validity of statement;
2. state field and order axioms of Real number system;
3. define functions and illustrate them graphically;
4. sketch the curves;
5. use trigonometrical relations to find the general values, understand inverse circular functions and their properties and to find property and solution of triangle;
6. state properties of A.S., G.S. and H.S. Understand infinite series and use method of mathematical induction to establish the result;
7. define transpose, adjoint and inverse of matrix, state properties of determinants;
8. use matrix and determinant to solve system of linear equations;
9. explain the idea of a complex number, verify their properties, prove De-Moivre's theorem and use it;
10. define polynomial equations, establish fundamental theorem of algebra and quadratic equation, and find relation between roots and coefficients of a quadratic polynomials;
11. define straight lines, pair of lines in terms of co-ordinates and establish their properties;
12. define circle in terms of coordinates and establish their properties;
13. define limit of a function, establish properties of limits;
14. define continuity of a function using the concept of limit;
15. define derivative of a function and give its geometrical interpretation as rate of change;
16. use derivative to determine the nature of the function and determine the maxima and minima of a function and apply differentiation to find tangent and normal, increasing and decreasing function;
17. define antiderivative as an inverse process of derivative and use various methods of integration; and
18. define integration as the area of the sum, and apply definite integral to find the area between the curves.

III. Course Contents:

Unit 1: Sets, Real Number System and Logic 10 hrs

Sets:

Sets and set operations, Theorems based on set operations.

Real Number System:

Real numbers, Field axioms, Order axioms, Interval, Absolute value, Geometrical representation of the real numbers.

Logic:

Introduction, statements, Logical connectives, Truth tables, Basic laws of logic.

Unit 2: Relations, Functions and Graphs 12 hrs

Relations:

Ordered pair, Cartesian product, Geometrical representation of Cartesian product, relation, Domain and range of a relation, Inverse of a relation.

Function:

Definition, Domain and range of a function, Functions defined as mappings, Inverse function, Composite function, functions of special type (Identity, Constant, Absolute value, Greatest integer), Algebraic (Linear, quadratic and cubic), Trigonometric, Exponential logarithmic functions and their graphs.

Unit 3: Curve Sketching 10 hrs

Odd and even functions, Periodicity of a function, symmetry (about x-axis, y-axis and origin) of elementary functions, Monotonicity of a function, Sketching graphs of polynomial functions $\left(\frac{1}{x}, \frac{x^2 - a^2}{x - a}, \frac{1}{x + a}, x^2, x^3\right)$, Trigonometric, exponential, logarithmic functions (Simple cases only)

Unit 4: Trigonometry 10 hrs

Inverse circular functions, Trigonometric equations and general values, properties of a triangle (sine law, Cosine law, tangent law, Projection laws, Half angle laws), the area of a triangle. Solution of a triangle (simple cases)

Unit 5: Sequence and Series, and Mathematical Induction 12 hrs

Sequence and Series:

Sequence and series, type of sequence and series (Arithmetic, Geometric, Harmonic), Properties of Arithmetic, Geometric, and Harmonic sequences, A.M., G.M. and H.M. Relation among A.M., G.M. and H.M., Sum of infinite geometric series.

Mathematical Induction:

Sum of finite natural numbers, Sum of the squares of first n-natural numbers, Sum of cubes of first n-natural numbers. Intuition and induction, principle of mathematical induction.

Unit 6: Matrices and Determinants 8 hrs

Matrices and operation on matrices (Review), Transpose of a matrix and its properties, Minors and Cofactors, Adjoint, Inverse matrix. Determinant of a square matrix, properties of determinants (Without proof) upto 3×3 .

- Unit 7: System of Linear Equations** **8 hrs**
 Consistency of system of linear equations, solution of a system of linear equations by Cramer's rule, Matrix method (row - equivalent and Inverse) upto three variables.
- Unit 8: Complex Number** **12 hrs**
 Definition of a complex number, Imaginary unit, Algebra of complex numbers, Geometric representation of a complex number, Conjugate and absolute value (Modulus) of a complex numbers and their properties, Square root of a complex number, Polar form of a complex number, product and Quotient of complex numbers. De Moivre's theorem and its application in finding the roots of a complex number, properties of cube roots of unity.
- Unit 9: Polynomial Equations** **8 hrs**
 Polynomial function and polynomial equations, Fundamental theorem of algebra (without proof), Quadratic equation Nature and roots of a quadratic equation, Relation between roots and coefficients, Formation of a quadratic equation, Symmetric roots, one or both roots common.
- Unit 10: Co-ordinate Geometry** **12 hrs**
Straight line:
 Review of various forms of equation of straight lines, Angle between two straight lines, condition for parallelism and perpendicularity, length of perpendicular from a given point to a given line, Bisectors of the angles between two straight lines.
Pair of lines:
 General equation of second degree in x and y, condition for representing a pair of lines, Homogeneous second degree equation in mx and y, Angle between pair of lines, Bisectors of the angles between pair of lines.
- Unit 11: Circle** **10 hrs**
 Equation of a circle in various forms (Centre at origin, centre at any point, general equation of a circle, circle with a given diameter), Condition of Tangency of a line at a point to the circle, Tangent and normal to a circle.
- Unit 12: Limits and Continuity** **10 hrs**
 Limits of a function, Indeterminate forms, Algebraic properties of limits (without proof), Theorem on limits of algebraic, Trigonometric, Exponential and logarithmic functions $\left(\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}, \lim_{x \rightarrow 0} \sin x, \lim_{x \rightarrow 0} \frac{\sin x}{x}, \lim_{x \rightarrow 0} \frac{e^x - 1}{x}, \lim_{x \rightarrow 0} \frac{\log(1 + x)}{x} \right)$
 Continuity of a function, Types of discontinuity, Graph of discontinuous function.
- Unit 13: The Derivatives** **8 hrs**
 Derivative of a function, Derivatives of algebraic, trigonometric, exponential and logarithmic functions by definition (simple forms), Rules of differentiation, Derivatives of parametric and implicit functions, Higher order derivatives.
- Unit 14: Applications of Derivatives** **12 hrs**
 Geometric interpretation of derivative, Monotonocity of a function, Interval of monotonocity, Extrema of a function, Concavity, Points of inflection, Derivative as rate measure.

Unit 15: Antiderivatives and its Applications**10 hrs**

Antiderivative, Integration using basic integrals, Integration by substitution and by parts method the definite integral, The definite integral as an area under the given curve, Area between two curves.

IV. Evaluation Scheme:

No. of questions	Marks	Total	Remarks
15	2	30	covering all units
10	4	40	with four OR-questions from the same
5	6	30	with two OR-questions from the same

The questions of 6 marks will be asked from the units with 12 or more credit hours.

V. Reference books:

1. Bajracharya, Prakash Muni, Fundamentals of Mathematics-XI, Buddha Publication, Ktm
2. Adhikari, D. B., Elements of Mathematics-XI, Ekata Books and Distributors, Ktm
3. G.C. Phan Bahadur et. al., Mathematics-XI, Asmita Books Publication, Ktm
4. Awasthi, Ramesh Prasad, Mathematics XI, Unice Educational Publication, Ktm
5. Mahato, Hem Chandra et. al., Mathematics-XI, G-7 Publication Pvt. Ltd., Ktm
6. Mishra, Sailendra Kumar et. al., Conceptual Mathematics0-XI, Divya Deuralis Publication, ktm
7. Bajracharya, D. R. and et. al., Basic Mathematics-XI, Sukunda Pustak Bhawan, Ktm
8. Sharma Basant Raj et. al., Essentials of Mathematics-XI, I.M. Publication Pvt. Ltd., Ktm