# Syllabus of Assam Mathematics Olympiad
## Assam Academy of Mathematics

### Category - I (Classes V - VI)

• Number system. Concepts and problems related to place value and face value in the decimal number system. Use of the symbols =, < and >. Estimation of numbers, identifying smaller, larger etc. Natural numbers, whole numbers, integers. Properties of numbers (commutative, associative, distributive, additive identity, multiplicative identity, additive inverse, multiplicative inverse). Representation of integers on the number line.

• Statement problems involving the basic rules of addition, subtraction, multiplication and division. Conversions of units of length & mass (from the larger to the smaller units and vice-versa), Simplification of brackets, multiples and factors, divisibility rules and related problems. Even numbers, odd and prime numbers, composite numbers, co-prime numbers. Factorisation of numbers. HCF and LCM, prime factorization and division methods for HCF and LCM, the property LCM × HCF = product of two numbers.

• Fractions, representation of fractions (pictorially and on number line), fraction as a division, proper, improper & mixed fractions, equivalent fractions, comparison of fractions, addition and subtraction of fractions. Idea of a decimal fraction, place value in the context of decimal fraction, inter conversion of fractions and decimal fractions, word problems involving arithmetic operations on decimals. Ratio and Proportion, Unitary method, statement problems.

• Line, line segment, ray. Open and closed figures. Interior and exterior of closed figures. Angles - acute, obtuse, right, straight, reflex, complete and zero angle. Triangles — vertices, sides, angles, altitude and median. Classification of triangles (on the basis of sides and of angles). Quadrilaterals — sides, vertices, angles, diagonals, adjacent sides and opposite sides. Trapezium, parallelogram, rectangle, square, rhombus. Circles — centre, radius, diameter, arc, sector, chord, segment, semicircle, circumference. Intersecting and perpendicular lines, parallel lines

• Knowledge of 3-D shapes: Cubes, Cuboids, cylinder, sphere, cone, prism, pyramid and tetrahedrons. Symmetry of geometrical shapes, letters, words, numbers. Constructions (using straight edge, protractor, compasses) - line segment, circle, perpendicular bisector, angles, angle bisection, angle equal to a given angle (using compass), drawing a line perpendicular to a given line from a point on the line and from a point outside the line.

• Areas and perimeters of standard geometrical figures - triangle, rectangle, rhombus, square, parallelogram, circle, trapezium. Shapes of different kinds with the same perimeter/area. Patterns of geometrical shapes and designs.

• Data handling, collection and organisation of data in tally bars and a table, making bar graphs for given data interpreting bar graphs.

### Category - II (Classes VII - VIII)

• Properties of integers (including identities for addition & multiplication, commutative, associative, distributive). Word problems including integers. Rational numbers - representation on number line, properties of rational numbers , operations on rational numbers, finding rational numbers between two rational numbers statement problems involving rational numbers. Number puzzles and games.

• Laws of exponents with integral powers. Square and Square roots. Square roots using factor method and division method for numbers. Cubes and cubes roots. Estimating square roots and cube roots.

• Algebraic expressions involving one or two variables. Constants, coefficients, powers, like and unlike terms. Polynomials degree of polynomials, addition, subtraction of polynomials. Algebraic identities, factorisation of polynomials, division of polynomials.

• Problems on percentages, profit & loss, overhead expenses, discount, ratio and proportion, unitary method, simple interest, compound interest, direct and inverse variation, time & work problems.

• Pairs of angles (linear pair, supplementary, complementary, adjacent, vertically opposite). Properties of parallel lines with transversal (alternate, corresponding, interior, exterior angles). Angle sum property of triangle, exterior angle property, triangle inequality of sides, Pythagoras

Theorem. Angle sum property of quadrilateral. Properties of rectangles, squares, rhombus, parallelograms.

• Reflection and rotational symmetry. Counting vertices, edges & faces & verifying Euler's relation for 3-D figures with flat faces (cubes, cuboids, tetrahedrons, prisms and pyramids). Congruence of triangles, SSS, SAS, AAS, ASA and RHS criteria. Construction of triangles, parallel lines, quadrilaterals using ruler and compass.

• Areas of a square, rectangle, triangle, parallelogram and circle, trapezium, area between two rectangles and two concentric circles, volume of a cube, cuboid and cylinder, Surface area of a cube, cuboid, cylinder, related problems.

• Basic ideas of set theory - types of sets, subsets, null set, finite and infinite sets, union and intersection of sets, complement of a set. Principles of counting - addition rule, subtraction rule, multiplication rule and division rule. Permutation and combination of objects, related problems.

• Mean, median and mode of ungrouped and grouped data. Constructing and interpreting bar-graphs. Simple Pie charts with reasonable data numbers.

## Category - III (Classes IX - XI)

• Number systems, rational numbers, irrational numbers, real numbers. Number theory - well ordering principle, division algorithm, divisibility theory, GCD and LCM, Euclidean algorithm, Diophantine Equation, prime numbers and their properties, fundamental theorem of arithmetic, theory of congruences, linear congruences, Fermat's little theorem, Wilson's theorem. Number theoretic functions $\tau$, $\sigma$ and Euler's $\varphi$ function, Euler's theorem. Greatest integer function.

• Sets, relations and functions. One-one functions, onto functions, bijections, inverse of a bijection. Counting principles - addition rule, subtraction rule, multiplication rule, division rule. Permutation and combination of distinct objects. Permutations and combinations with repetitions. Inclusion-Exclusion principle. Pigeonhole principle.

• Polynomials in one variable, coefficients, terms, degree of a polynomial. Constant, linear, quadratic, cubic polynomials; monomials, binomials, trinomials etc. Factors and multiples. Zeros/roots of a polynomial/equation. Relation between roots and coefficients. Remainder Theorem, Factor Theorem and related problems. Algebraic identities involving several variables. Linear equations in two variables, the cases of unique solution, no solution and infinitely many solutions. Quadratic equations. Statement problems.

• Arithmetic, geometric and harmonic progressions. Inequalities involving arithmetic mean, geometric mean and harmonic mean. Cauchy Schwartz inequality.

• Euclidean Geometry, lines and angles, triangles, quadrilaterals, circles, and their properties, congruence and similarity of triangles. Mensuration - area, perimeter, surface area and volumes of standard geometrical objects.

**Recommended books**

• NCERT / SEBA / AHSEC recommended textbooks.

• Elementary Number Theory; David M. Burton; McGraw Hill Education.

• Introductory combinatorics; Richard A. Brualdi; Pearson Education Inc.

• Mathematical Circles; Dmitri Fomin, Sergey Genkin, Ilia Itenberg; Universities Press.

• A Moscow Math Circle; Sergey Dorichenko; Universities Press.

• Functional Equations; B.J.Venkatachala; Prism Books Pvt. Ltd.

• International Mathematical Olympiad (Volumes I to III); Istvan Reiman; Anthem Press.

• Problem Solving Strategies; Arthur Angel; Springer.

• Challenge and thrill of pre-college mathematics; V.K.Krishnamurthy et.al.; New Age International Publishers.

***The students can retain the syllabus copy while submitting the form.***