# ZIAUDDIN UNIVERSITY EXAMINATION BOARD

# Secondary School Certificate

# (SSC)

# Examination Syllabus

# General Mathematics

# X

# Based on Provincial Revised Curriculum

# (Sindh)

**PREFACE**

The Ziauddin University Examination Board (ZUEB) was established under **Sindh ACT XLI 2018**, with the primary objective of enhancing the quality of education in Sindh. ZUEB is responsible for administering examinations for the **Secondary School Certificate (SSC)** and **Higher Secondary School Certificate (HSSC)** in alignment with the most recent revisions to the **National Curriculum**, as outlined by the **Directorate of Curriculum Assessment and Research (DCAR), Sindh**. Through its ordinance, ZUEB is mandated to provide examination services for both English, Urdu, and Sindhi medium candidates from private schools across Sindh. This examination syllabus reflects ZUEB's dedication to achieving the educational goals set by the provincial authorities.

In collaboration with subject professors, ZUEB has developed a comprehensive syllabus for each subject. It is important to distinguish between the syllabus and the curriculum. The syllabus serves as a guide for both teachers and students, outlining the key areas of focus within the subject. It provides students with a clear understanding of what is expected of them in their studies and helps them prepare effectively for their exams. This examination syllabus incorporates all cognitive outcomes derived from the **Provincial Curriculum Statement**, ensuring that assessments are both valid and reliable. While the focus is primarily on the cognitive domain, significant emphasis is placed on the application of knowledge and understanding.

The syllabus is made available to all stakeholders via the ZUEB website to assist affiliated schools in planning their teaching. It is crucial to note that the syllabus, rather than the prescribed textbook, forms the foundation of ZUEB examinations. Additionally, this syllabus supports the development of learning materials for both students and teachers. ZUEB remains committed to supporting students undertaking the SSC and HSSC courses by facilitating their learning outcomes through this detailed syllabus document.

To further assist in the learning process, ZUEB provides a dedicated **e-resource tab** on its website, offering both text-based and video content on various subjects. These 15–20-minute instructional videos, created around key subject concepts, allow students to learn at their own pace and convenience. The videos can be used as a reinforcement tool to revisit lessons already taught or as pre-lesson material. This initiative is an ongoing effort, and new videos will continue to be uploaded.

We encourage all students and educators to make the most of these resources for a more enriched and flexible learning experience.


Sincerely,

Saleem Ahmed

Manager Social Sciences

Ziauddin University Examination Board

## INTRODUCTION

Mathematics has been a cornerstone of human knowledge since ancient times, with civilizations such as the Egyptians, Babylonians, and Greeks recognizing its significance in solving real-world problems. The ancient Egyptians, for instance, used mathematical concepts to construct monumental pyramids, while the Babylonians developed sophisticated mathematical systems to track celestial bodies. The study of mathematics has continued to evolve over the centuries, and its importance in modern times cannot be overstated. As Galileo Galilei aptly put it, "Mathematics is the language with which God has written the universe."

In today's rapidly changing world, mathematics education is more crucial than ever. It equips students with the skills to analyze complex problems, think critically, and make informed decisions. Mathematics teaching can develop a range of skills in students, including problem-solving, logical reasoning, and analytical thinking. By mastering mathematical concepts, students can cultivate a deeper understanding of the world around them and develop a sense of curiosity and wonder. As Albert Einstein noted, "Pure mathematics is, in its way, the poetry of logical ideas."

In the Pakistani context, mathematics education literacy is essential for the country's economic and technological development. With a growing population and increasing global competition, Pakistan needs a mathematically literate workforce to drive innovation and growth. Mathematics education can support learning in other subjects, such as science, technology, and engineering, by providing a foundation for understanding complex concepts and phenomena. Moreover, mathematical thinking can be applied to a wide range of real-life situations, from personal finance to environmental sustainability. As Lynn Arthur Steen observed, "Mathematics is not just a subject, but a way of thinking about the world."

The study of mathematics has far-reaching implications for real life, enabling individuals to navigate complex systems, evaluate evidence, and make informed decisions. By incorporating mathematics education into the curriculum, we empower students to become critical thinkers, problem-solvers, and innovators who can contribute to Pakistan's development and progress. Through mathematics education, students can develop a deeper understanding of the world and their place in it, enabling them to make a positive impact in their communities and beyond.

# STANDARDS for GENERAL MATHEMATICS GRADE X

Following standards have been framed for Grade X General Mathematics Education. These standards are followed by bench marks. These bench marks further divided into student learning outcomes for each learning area.

These are the details of each standard:

## Standard 1: Algebraic Formulas and Applications

The student should be able to demonstrate a thorough understanding of algebraic expressions and formulas by accurately simplifying and manipulating complex expressions, applying algebraic formulas to solve problems, and using surds and rationalization to simplify irrational expressions.

## Standards 2: Factorization

The student will be able to develop a deep understanding of factorization, remainder theorem, and factor theorem by accurately factorizing polynomials, applying the remainder theorem to find remainders, and using the factor theorem to determine factors of polynomials. They should be able to factorize cubic polynomials and apply these concepts to solve equations and problems.

## Standard 3: Algebraic Manipulation

Students will be able to showcase a thorough understanding of HCF and LCM, algebraic fractions, and square roots of algebraic expressions by accurately finding highest common factors and least common multiples, performing basic operations on algebraic fractions, and finding square roots of algebraic expressions. They should be able to apply these concepts to solve equations and problems, demonstrating a strong foundation in algebraic manipulation and problem-solving.

**Standard 4: Linear Equations and Inequations**

Students will be able to exhibit mastery of linear equations and inequalities by consistently solving equations involving absolute value, linear inequalities, and systems of linear equations. They will be able to interpret and analyze solutions, demonstrating a deep understanding of linear relationships and their applications in real-world contexts.

**Standard 5: Quadratic Equation**

Students will be able to exhibit mastery of quadratic equations by accurately solving quadratic equations using various methods, including factorizing, completing the square, and applying the quadratic formula. They should be able to analyze and interpret solutions, demonstrating a strong understanding of the properties of quadratic relationships and their applications in real-world contexts.

**Standard 6: Matrices and Determinants**

Students will be able to develop expertise in working with matrices by accurately identifying and classifying different types of matrices, performing operations such as addition, subtraction, and multiplication, and finding the multiplicative inverse of a matrix. They should be able to apply matrices to solve systems of simultaneous linear equations.

**Standard 7: Fundamentals of Geometry**

Students will be able to demonstrate a comprehensive understanding of geometric concepts by accurately applying properties of angles, parallel lines, congruent and similar figures, and geometrical theorems to solve problems. They should be able to identify and prove congruent triangles, analyze properties of quadrilaterals, and apply circle theorems to solve problems, showcasing a strong foundation in geometric reasoning and proof.

**Standard 8: Practical Geometry**

Students will be able to demonstrate proficiency in geometric constructions by accurately constructing triangles and quadrilaterals using various methods, and drawing tangents to circles. They should be able to apply geometric principles to justify constructions, demonstrating a strong foundation in geometric reasoning and proof.

**Standard 9:**

Students will be able to exhibit mastery of geometric measurement by accurately applying the Pythagoras theorem to solve problems involving right-angled triangles, calculating areas of various shapes, and determining volumes of three-dimensional objects. They should be able to apply mathematical formulas and reasoning to solve real-world problems, demonstrating a strong foundation in geometric measurement and calculation.

**Standard 10: Introduction to Coordinate Geometry**

Students should be able to demonstrate a thorough understanding of coordinate geometry by accurately applying the distance formula to find distances between points in a coordinate plane and determining whether points are collinear. They should be able to use mathematical reasoning and formulas to solve problems involving points and lines in a coordinate plane

# Key

**K** = Knowledge

**U** = Understanding

**A** = Application and other higher order cognitive skills

**CRQs** = Constructed Response Questions

**ERQs** = Extended Response Questions

**CA** = Classroom Activity

**ECA** = Extended Classroom Activity

(ECAs are not to be assessed under examination condition)

**Syllabus General Mathematics X**

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level[1] | | |
|---|---|---|---|---|
| **A: Algebraic Formula and Applications** | Student will be able to: | **K** | **U** | **A** |
| **Algebraic Expressions** | A-1 Define a rational expression as the quotient $\frac{p(x)}{q(x)}$ of two polynomials | * | | |
| | A-2 Identify whether a given algebraic expression is a polynomial or not, rational expression or not | | * | |
| | A-3 Describe $\frac{p(x)}{q(x)}$ as a rational expression to its lowest terms | | * | |
| | A-4 Simplify a given rational expression to its lowest terms | | | * |
| | A-5 Solve problems based on multiplication and division of rational expression in its lowest terms | | | * |
| | A-6 Find the value of algebraic expression for a given real number | | | * |
| **Algebraic Formulas** | A-7 Derive the formulae: $(a+b)^2 + (a-b)^2 = 2(a^2+b^2)$, $(a+b)^2 - (a-b)^2 = 4ab$, $a^2 - b^2 = (a-b)(a+b)$ | | | * |
| | A-8 Find the value of ( $a^2 + b^2$ ), $(a^2 - b^2)$, $(a+b)$, $(a-b)$ and *(ab)* using the above formulae | | | * |
| | A-9 Derive the formula $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$ | | | * |
| | A-10 Find the values of $(a^2 + b^2 + c^2)$, $(a+b+c)$, $(ab+bc+ca)$ when values of any two of these are given in the above formula | | | * |
| | A-11 Derive the following formulae: $(a \pm b)^3 = a^3 \pm 3ab(a \pm b) \pm b^3$, $(a^3 \pm b^3) = (a \pm b)(a^2 \pm ab + b^2)$ | | | * |
| | A-12 Solve problems based on the above formula | | | * |
| | A-13 Find the continued product by using the formula e.g. $(x+y)(x-y)(x^2 + xy + y^2)(x^2 - xy + y^2)$ | | | * |
| **Surds and their Application** | A-14 Explain the surds of second order | | * | |
| | A-15 Apply basic operations on surds of second order to rationalize the denominators and evaluate it | | | * |

| Rationalization | A-16 Rationalize the denominator of real numbers $\frac{1}{a+b\sqrt{x}}$ , $\frac{1}{\sqrt{x}+\sqrt{y}}$ and their combinations | | | * |
| --- | --- | --- | --- | --- |
| **Topics & Sub-topics** | **Student Learning Outcome** | **Cognitive Level** | | |
| **B: Factorization** | Student will be able to: | **K** | **U** | **A** |
| **Factorization** | B-1 Factorize the expression of the following types:<br>kx + ky + kz<br>ax + ay + bx + by<br>$a^2 \pm 2ab + b^2$<br>$a^2 - b^2 \ (a^2 \pm 2ab + b^2) - c^2$<br>$a^4 + a^2 b^2 + b^4 \ or \quad a^4 + 4b^4$<br>$x^2 + px + q$<br>$ax^2 + bx + c$<br>$a^3 \pm 3ab\,(a \pm b) \pm b^3$<br>$a^3 \pm b^3$ | | | * |
| **Remainder Theorem and Factor Theorem** | B-2 Apply the Remainder Theorem | | | * |
| | B-3 Find the remainder (without dividing) when a polynomial is divided by a linear polynomial | | | * |
| | B-4 Define zeros of a polynomial | * | | |
| | B- 5 Explain factor theorem through examples | | * | |
| **Factorization of Cubic Polynomial** | B-6 Use factor theorem to factorize a cubic polynomial | | | * |
| **Topics & Sub-topics** | **Student Learning Outcome** | **Cognitive Level[2]** | | |
| **C: Algebraic Manipulation** | Student will be able to: | **K** | **U** | **A** |
| | | | | |
| **Highest Common Factor (HCF) and Least Common Multiple (LCM)** | C-1 Find the Highest Common Factor (HCF) and Least Common Multiple (LCM) of algebraic expression | | | * |
| | C-2 Use factor or division method to determine HCF and LCM | | | * |
| | C-3 Describe relationship between HCF and LCM | | * | |
| **Basic Operations on Algebraic Fractions** | C-4 Use HCF and LCM to reduce fractional expression involving +, -, x, ÷ | | | * |
| **Square root of Algebraic Expression** | C-5 Find the square root of an algebraic expression by factorization and division methods | | | * |

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level | | |
|---|---|---|---|---|
| **D: Linear Equations and Inequations** | Student will be able to: | **K** | **U** | **A** |
| **Linear Equation** | D-1 Solve linear equations with rational coefficients | | | * |
| | D-2 Reduce equations, involving radicals to simple linear form and find their solutions | | | * |
| **Equation involving Absolute Value** | D-3 Define absolute value | * | | |
| | D-4 Solve the equation, involving absolute value in one variable | | | * |
| **Linear Inequalities** | D-5 Define inequalities (>,<) and (≥,≤) | * | | |
| | D-6 Recognize properties of inequalities (i.e. trichotomy, transitive, additive and multiplicative) | | * | |
| **Solving Linear Inequalities** | D-7 Solve linear inequalities with rational coefficients | | | * |

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level[3] | | |
|---|---|---|---|---|
| **E: Quadratic Equation** | Student will be able to: | **K** | **U** | **A** |
| **Quadratic Equation** | E-1 Define Quadratic Equation | * | | |
| **Solutions of Quadratic Equations** | E-2 Solve quadratic equation in one variable by Factorization and Completing the Square Method | | | * |
| **Quadratic Formula** | E-3 Apply the method of completing the square to derive a quadratic formula | | | * |
| | E-4 Use the quadratic formula to solve quadratic equations | | | * |
| | E-5 Solve word problems based on quadratic equations and verify and validate solutions | | | * |

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level | | |
|---|---|---|---|---|
| **F: Matrices and Determinants** | Student will be able to: | **K** | **U** | **A** |
| **Introduction to Matrices** | F-1 Define matrix with real entries | * | | |
| **Types of Matrices** | F-2 Define row matrix, column matrix, square matrix, zero/null matrix, identity matrix, scalar matrix, diagonal matrix, symmetric matrix | * | | |

| Topics & Sub-topics | Student Learning Outcome | K | U | A |
|---|---|---|---|---|
| **Addition and Subtraction of Matrices** | F-3 Find the transpose of a matrix | | | * |
| | F-4 Discuss whether the given matrices are conformable for addition/subtraction | | | * |
| | F-5 Find the addition and subtraction of matrices | | | * |
| | F-6 Verify commutative and associative laws under addition | | | * |
| | F-7 Define the additive identity of a matrix | * | | |
| | F-8 Find the additive inverse of a matrix | | | * |
| **Multiplication of Matrices** | F-9 Explain multiplication of matrices (up to order 2 x 2) | | * | |
| | F-10 Discuss whether the given matrices conformable for multiplication | | | * |
| | F-11 Find the multiplication of a matrix by a real number | | | * |
| | F-12 Find the multiplication of two or three matrices | | | * |
| | F-13 Verify Associative Law under multiplication | | | * |
| | F-14 Verify Distributive Laws | | | * |
| | F-15 Verify with the help of examples that commutative law under multiplication does not hold in general (i.e. AB ≠ BA) | | | * |
| | F-16 Verify with the help of examples that (AB)' = B' A' | | | * |
| | F- 17 Describe the determinant of a square matrix | | * | |
| | F-18 Calculate the determinant of a matrix | | | * |
| | F-19 Define Singular and non-singular matrix | * | | |
| | F-20 Find the adjoint of a matrix and related problems | | | * |
| | F-21 Define the multiplicative identity of a matrix | * | | |
| **Multiplicative Inverse of a Matrix** | F-22 Find the multiplicative inverse of a non-singular matrix A and verify that $A^{-1} = I = ? A^{-1}A$ where I is the multiplicative identity matrix | | | * |
| | F-23 Apply adjoint method to calculate the inverse of a non-singular matrix | | | * |
| | F-24 Verify $(AB)^{-1} = B^{-1} A^{-1}$ the result with the help of examples | | | * |
| **Solution of Simultaneous Linear Equations** | F-25 Solve a system of two linear equations and word problems in two unknowns using the inverse Matrix Method, Cramer's Rule | | | * |

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level[4] | | |
|---|---|---|---|---|
| **G: Fundamentals of Geometry** | Student will be able to: | K | U | A |
| **Properties of Angles** | G-1 Illustrate adjacent, complementary, and supplementary angles and vertically opposite angles | | | * |

| Topic | Learning Outcome | | | |
|---|---|---|---|---|
| | G-2 Calculate unknown angles involving adjacent angles, complementary angles, supplementary angles, and vertically opposite angles | | | * |
| | G-3 Calculate the unknown angle associated with a triangle (interior and exterior angles) | | | * |
| **Parallel Lines** | G-4 Illustrate the properties of parallel lines through figures | | | * |
| | G-5 Apply the properties of parallel lines to solve related problems | | | * |
| | G-6 Illustrate corresponding angles, alternate angles, and interior angles | | | * |
| | G-7 Apply the properties of corresponding angles, alternate angles, interior angles, and pairs of interior angles in problem-solving | | | * |
| **Congruent and Similar Figures** | G-8 Describe congruent and similar figures and symbols used to present them | | * | |
| **Congruent Triangles** | G-9 Describe the properties of congruent triangles: SSS ≅ SSS, SAS ≅ SAS, AAS ≅ AAS, RHS ≅ RHS | | * | |
| | G-10 Apply the properties of congruency and similarity to find the unknown measurement of a triangle | | | * |
| **Quadrilaterals** | G-11 Apply the properties of a square to find the unknown measurements | | | * |
| | G-12 Apply the properties of a rectangle to find the unknown measurements | | | * |
| | G-13 Apply the properties of a parallelogram to find the unknown measurements | | | * |
| **Circle** | G-14 Define circle and its parts such as center, radius, diameter, chord, arc, major and minor arcs, semi-circle, and segment of the circle | * | | |
| | G-15 Describe the sector and secant of a circle, concyclic points, tangent to a circle, and concentric circles | | * | |
| **Theorems** | G-16 Theorems based on lines, triangles, squares, rectangles, parallelograms, and circle | | | * |

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level[5] | | |
|---|---|---|---|---|
| **H: Practical Geometry** | Student will be able to: | K | U | A |
| **Construction of Triangle** | H-1 Draw a triangle when sides or angles or sides and angles are given | | | * |
| | H-2 Draw angle bisectors, altitudes, perpendicular bisectors, medians of a given triangle and verify their concurrency | | | * |
| **Construction of Quadrilateral** | H-3 Draw a rectangle when two adjacent sides or diagonal and one side are given | | | * |
| | H-4 Draw a square when its diagonal is given | | | * |
| | H-5 Draw a parallelogram when two adjacent sides and the angle included between them are given | | | * |
| **Tangent to the Circle** | H-6 Locate the center of a given circle | | * | |
| | H-7 Draw a circle passing through three given non-collinear points | | | * |
| | H-8 Draw a tangent to a given circle from a point 'P' when 'P' lies: on the circumference, outside the circle | | | * |
| | H-9 Draw a common tangent or external tangent, Transverse Common Tangent or Internal Tangent to two equal circles | | | * |
| | H-10 Draw Direct Common Tangent or External Tangent, Transverse Common Tangent or Internal Tangent to two unequal circles | | | * |
| | H-11 Draw a Tangent to two unequal touching circles, two unequal intersecting circles. | | | * |

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level | | |
|---|---|---|---|---|
| **I: Areas and Volumes** | Student will be able to: | K | U | A |
| **Pythagoras Theorem** | I-1 State Pythagoras Theorem | * | | |
| | I-2 Calculate unknown elements of right-angle triangle using Pythagoras Theorem | | | * |
| **Areas** | I-3 Find the area of <br> • a triangle when three sides are given (Apply Heron's Formula), <br> • A triangle whose base and attitude (height) are given, <br> • An equilateral triangle when one side is given. | | | * |

| | | | | |
|---|---|---|---|---|
| **Volumes** | I-4 Find the area of<br>• a rectangle when its two adjacent sides are given,<br>• a parallelogram when base and attitude (height) are given,<br>• a square when its one side is given. | | | * |
| | I-5 Find the area of<br>• a circle and semi-circle when the radius/diameter is given,<br>• Find the area enclosed by two concentric circles whose radii are given. | | | * |
| | I-6 Solve problems related to areas of triangle, rectangle, square, parallelogram, and circle | | | * |
| | I-7 Solve problems related to the volume of cube, cuboid, cylinder, cone, and sphere. | | | * |

| Topics & Sub-topics | Student Learning Outcome | Cognitive Level[6] | | |
|---|---|---|---|---|
| **J: Introduction to Coordinate Geometry** | Student will be able to: | **K** | **U** | **A** |
| **Distance Formula** | J- 1 Describe coordinate geometry | | * | |
| | J-2 Derive distance formula to find the distance between two points given in Cartesian Plane | | | * |
| | J-3 Apply the distance formula to find the distance between two given points | | | * |
| **Collinear Points** | J-4 Define Collinear points | * | | |
| | J-5 Distinguish between collinear and non-collinear points | | | * |
| | J-6 Apply distance formula to show whether the given points are collinear or non-collinear | | | * |
| | J-7 Apply the distance formula to show that the given three non-collinear points form: an equilateral triangle, an isosceles triangle, a right-angles triangle, a scalene triangle | | | * |
| | J-8 Apply the formula to find the midpoint of the line segment joining two given points | | | * |
| | J-9 Solve problems related to the midpoint formula | | | * |

Scheme of Assessment

**Subject: General Mathematics**                                                    **Grade: X**


**Table 1: Number of Student Learning Outcomes by Cognitive Level**

| Topic No. | Topics | No. of Sub-topics | SLOs[7] | | | Total |
|---|---|---|---|---|---|---|
| | | | K | U | A | |
| 1 | A: Algebraic Formula and Applications | 4 | 1 | 3 | 12 | 16 |
| 2 | B: Factorization | 3 | 1 | 1 | 4 | 6 |
| 3 | C: Algebraic Manipulation | 3 | -- | 1 | 4 | 5 |
| 4 | D: Linear Equations and Inequations | 4 | 2 | 1 | 4 | 7 |
| 5 | E: Quadratic Equation | 3 | 1 | -- | 4 | 5 |
| 6 | F: Matrices and Determinants | 6 | 5 | 2 | 18 | 25 |
| 7 | G: Fundamentals of Geometry | 7 | 1 | 3 | 12 | 16 |
| 8 | H: Practical Geometry | 3 | -- | 1 | 10 | 11 |
| 9 | I: Areas and Volumes | 3 | 1 | -- | 6 | 7 |
| 10 | J: Introduction to Coordinate Geometry | 2 | 1 | 1 | 7 | 9 |
| | **Total** | **38** | **13** | **13** | **81** | **107** |
| | **Percentage** | | **12%** | **12%** | **76%** | **100%** |


**Table 2: Exam Specification**


| Topic No. | Topics | Assessment Items Distribution | | |
|---|---|---|---|---|
| | | MCQs | CRQs | ERQs |
| 1 | A: Algebraic Formula and Applications | 2 | 1 | 1 |
| 2 | B: Factorization | 1 | 1 | 1 |
| 3 | C: Algebraic Manipulation | 1 | -- | 1 |
| 4 | D: Linear Equations and Inequations | 2 | 1 | -- |
| 5 | E: Quadratic Equation | 1 | 1 | -- |
| 6 | F: Matrices and Determinants | 4 | 1 | 1 |
| 7 | G: Fundamentals of Geometry | -- | 2 | -- |
| 8 | H: Practical Geometry | -- | 1 | -- |
| 9 | I: Areas and Volumes | 2 | 1 | |
| 10 | J: Introduction to Coordinate Geometry | 2 | 1 | 1 |
| | **Total** | **15** | **10** | **5** |

**Table 3: Marks Distribution Section-wise**

| Sections in Exam Paper[8] | A | B | C | Total |
|---|---|---|---|---|
| Types of Assessment Items in each Section | MCQs | CRQs | ERQs | |
| Total number of Items given in each Section | 15 | 10 | 5 | |
| Number of Items to be attempted in each Section | 15 | 6 | 3 | |
| Maximum Marks for each Item | 1 | 5 | 10 | |
| (Marks for each item x No. of items) **Maximum Marks for each Section** | **1 x 15= 15** | **5 x 6= 30** | **10 x 3= 30** | **75** |
| **Percentage** | **20%** | **40%** | **40%** | **100%** |