



آغا خان یونیورسٹی ایگزامینیشن بورڈ
AGA KHAN UNIVERSITY EXAMINATION BOARD

**Secondary School Certificate
Examination Syllabus**

**MATHEMATICS
CLASSES IX-X**

(based on National Curriculum 2006)

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**Secondary School Certificate
Examination Syllabus**

**MATHEMATICS
CLASSES IX-X**

**This subject is examined in both
May and September Examination sessions**

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For queries and feedback

Address: The Aga Khan University Examination Board
Bungalow No. 233/ E.I Lines, Daudpota Road, Karachi-Pakistan.

Phone: (92-21) 35224702-10

Fax: (92-21) 35224711

E-mail: examination.board@aku.edu

Website: <http://examinationboard.aku.edu>
<http://learningsupport.akueb.edu.pk>

Facebook: www.facebook.com/akueb

PREFACE

In pursuance of National Education Policy (1998-2010), the Curriculum Wing of the Federal Ministry of Education has begun a process of curriculum reform to improve the quality of education through curriculum revision and textbook development (Preface, National Curriculum documents 2000 and 2002).

AKU-EB was founded in August 2003 with the same aim of improving the quality of education nationwide. As befits an examination board it seeks to reinforce the National Curriculum revision through the development of appropriate examinations for the Secondary School Certificate (SSC) and Higher Secondary School Certificate (HSSC) based on the latest National Curriculum and subject syllabus guidance.

AKU-EB has a mandate by Ordinance CXIV of 2002 to offer such examination services to English and Urdu medium candidates for SSC and HSSC from private schools anywhere in Pakistan or abroad, and from government schools with the relevant permissions. It has been accorded this mandate to introduce a choice of examination and associated educational approach for schools, thus fulfilling a key objective of the National Curriculum of Pakistan: “Autonomy will be given to the Examination Boards and Research and Development cells will be established in each Board to improve the system” (ibid. para. 6.5.3 (ii)).

AKU-EB is committed to creating continuity of educational experience and the best possible opportunities for its students. In consequence it offered HSSC for the first time in September, 2007 to coincide with the arrival of its first SSC students in college or higher secondary school. Needless to say this is not an exclusive offer. Private candidates and students joining AKU-EB affiliated schools and colleges for HSSC Part I are eligible to register as AKU-EB candidates even though they have not hitherto been associated with AKU-EB.

This examination syllabus exemplifies AKU-EB’s commitment to national educational goals.

- It is in large part a reproduction, with some elaboration, of the Class IX and X National Curriculum of the subject.
- It makes the National Curriculum freely available to the general public.
- The syllabus recommends a range of suitable textbooks already in print for student purchase and additional texts for the school library.
- It identifies areas where teachers should work together to generate classroom activities and materials for their students as a step towards the introduction of multiple textbooks, another of the Ministry of Education’s policy provisions for the improvement of secondary education (ibid. para. 6.3.4).

This examination syllabus brings together all those cognitive outcomes of the National Curriculum statement which can be reliably and validly assessed. While the focus is on the cognitive domain, particular emphasis is given to the application of knowledge and understanding, a fundamental activity in fostering “attitudes befitting useful and peaceful citizens and the skills for and commitment to lifelong learning which is the cornerstone of national economic development”(Preface to National Curriculum documents 2000 and 2002).

To achieve this end AKU-EB has brought together university academics, teacher trainers, writers of learning materials and above all, experienced teachers, in regular workshops and subject panel meetings.

AKU-EB provides copies of the examination syllabus to subject teachers in affiliated schools to help them in planning their teaching. It is the syllabus, not the prescribed text book which is the basis of AKU-EB examinations. In addition, the AKU-EB examination syllabus can be used to identify the training needs of subject teachers and to develop learning support materials for students. Involving classroom teachers in these activities is an important part of the AKU-EB strategy for improving the quality of learning in schools.

The Curriculum Wing of the Federal Ministry of Education has recently released new subject specifications and schemes of study which have been implemented since September, 2008. These documents are a major step forward towards a standards-related curriculum and have been welcomed by AKU-EB. Our current SSC syllabuses have been revised to ensure conformity with the National Curriculum.

We stand committed to all students entering the SSC course as well as those who have recently embarked upon the HSSC course in facilitating their learning outcome. Our examination syllabus document ensures all possible support.



Dr. Thomas Christie
Director,
Aga Khan University Examination Board
July 2009

1. Aims/Objectives of the National Curriculum (2000)¹

The objectives of teaching Mathematics given in the National Curriculum document (2000) are as follows:

- 1.1 “To enable students to acquire understanding of concepts of Mathematics and apply them to the problems of the world they live in.
- 1.2 To provide the students with a sound basis for specialization in Mathematics at higher stages or to apply it in scientific and technical fields.
- 1.3 To enable the students to reason consistently, to draw correct conclusions for given hypotheses; and to inculcate in them a habit of examining any situation critically and analytically.
- 1.4 To enable the students to communicate their thoughts through symbolic expressions and graphs.
- 1.5 To develop sense of distinction between relevant and irrelevant data.
- 1.6 To give the students basic understanding and awareness of the power of Mathematics in generalization and abstraction.
- 1.7 To foster in students the spirit of exploration and discovery. ”

2. Rationale of the AKU-EB Examination Syllabus

2.1 General Rationale

2.1.1 In 2007, the Curriculum Wing of the Federal Ministry of Education (MoE) issued a revised part-wise Scheme of Studies. All subjects are to be taught and examined in both classes IX and X. It is therefore important for teachers, students, parents and other stakeholders to know:

- (a) that the AKU-EB Scheme of Studies for its SSC examination (Annex) derives directly from the 2007 Ministry of Education Scheme of Studies;
- (b) which topics will be examined in Class IX and in Class X;
- (c) at which cognitive level or levels (Knowledge, Understanding, Application and other higher order skills) the topics and sub-topics will be taught and examined;

¹ Government of Pakistan (2000), *National Curriculum; Mathematics Classes IX-X*, Islamabad, Ministry of Education (Curriculum Wing)

- 2.1.2 This AKU-EB examination syllabus addresses these concerns. Without such guidance teachers and students have little option other than following a single textbook to prepare for an external examination. The result is a culture of rote memorization as the preferred method of examination preparation. The pedagogically desirable objectives of the National Curriculum which encourage “observation, creativity and other higher order thinking [skills]” are generally ignored. AKU-EB recommends that teachers and students use multiple teaching-learning resources for achieving the specific objectives of the National Curriculum reproduced in the AKU-EB examination syllabuses.
- 2.1.3 The AKU-EB examination syllabuses use a uniform layout for all subjects to make them easier for teachers to follow. Blank sheets are provided in each syllabus for writing notes on potential lesson plans. It is expected that this arrangement will also be found helpful by teachers in developing classroom assessments as well as by question setters preparing material for the AKU-EB external examinations. The AKU-EB aims to enhance the quality of education through improved classroom practices and improved examinations.
- 2.1.4 The Student Learning Outcomes (SLOs) in Section 3 start with command words such as list, describe, relate, explain, etc. The purpose of the command words is to direct the attention of teachers and students to specific tasks that candidates following the AKU-EB examination syllabuses are expected to undertake in the course of their subject studies. The examination questions will be framed using the same command words or the connotation of the command words, to elicit evidence of these competencies in candidates’ responses. The definitions of command words used in this syllabus are given in Section 7. It is hoped that teachers will find these definitions useful in planning their lessons and classroom assessments.
- 2.1.5 The AKU-EB has classified SLOs under the three cognitive levels Knowledge (K), Understanding (U) and Application of knowledge and skills (A) in order to derive multiple choice questions and constructed response questions on a rational basis from the subject syllabuses ensuring that the intentions of the National Curriculum should be met in full. The weighting of marks to the Multiple Choice and Constructed Response Papers is also derived from the SLOs, command words and cognitive levels. In effect the SLOs derived from the National Curriculum determine the structure of the AKU-EB subject examination set out in Section 4.
- 2.1.6 Some topics from the National Curriculum have been elaborated and enriched for better understanding of the subject and/or to better meet the needs of students in the twenty-first century.

2.2. Specific Rationale of the AKU-EB Mathematics Examination Syllabus

- 2.2.1 The teaching of Mathematics at secondary level should focus on improving mathematical skills and logical thinking to enable the students to keep pace with the growing demands of science and technology and the related fields.
- 2.2.2 The current National Curriculum covers a wide array of topics that need to be looked at critically and give more time for deeper conceptual understanding of Mathematics. The mismatch in content weight has been balanced by allocating marks for each cognitive level e.g. Knowledge, Understanding and Application. This guidance will help both teachers and students to prepare for the AKU-EB examination leading to increased student achievements.
- 2.2.3 While the National Curriculum provides a framework for the subject areas, the AKU-EB syllabuses specifically outlines learning objectives for making classroom practices more effective. In order to bring the use of mathematics more closely in line with everyday life and to avoid rote learning, students should not be assessed on reproducing theorems. Rather they will be assessed on the application of these theorems.

3. Topics and Student Learning Outcomes of the Examination Syllabus

SSC Part I (Class IX)

Topics	Student Learning Outcomes		Cognitive Levels ²		
			K	U	A
1. Real and Complex Numbers	Candidates should be able to:				
1.1 Real Numbers	1.1.1	describe terminating, non terminating, recurring, non recurring decimal fractions as rational and irrational numbers;		*	
	1.1.2	identify the set of real numbers as a union of sets of rational and irrational numbers;	*		
	1.1.3	locate real numbers on the number line;		*	
1.2 Properties of Real Numbers	1.2.1	describe the properties of real numbers (closure, commutative, associative, identities, inverse, distributive properties);		*	
1.3 Radicals and Radicands	1.3.1	identify radicals, radicands;	*		
	1.3.2	convert radical form to exponential form and vice versa;			*
1.4 Laws of Exponents/Indices	1.4.1	simplify expressions containing exponents;			*
	1.4.2	verify and apply the laws of exponents to simplify expressions with real base and exponents $x^m \cdot x^n = x^{m+n}, (xy)^m = x^m y^m, (x^m)^n = x^{mn}, \left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}, y^0 = 1, \frac{x^m}{x^n} = x^{m-n}; x \neq 0$			*
1.5 Complex Numbers	1.5.1	describe complex number z represented by an expression of the form $z = a + ib$, where a and b are real numbers and $i = \sqrt{-1}$;		*	
	1.5.2	identify a as real part and b as imaginary part of $z = a + ib$;	*		
	1.5.3	solve problems based on the conjugate of a complex number;			*

² K = Knowledge, U = Understanding, A= Application (for explanation see Section 7: Definition of command words used in Student Learning Outcomes and in Examination Questions).

NOTES

			K	U	A
	1.5.4	describe the condition for equality of complex numbers;		*	
	1.5.5	apply the condition for equality of complex numbers;			*
1.6	Basic Operations on Complex Numbers	1.6.1	apply basic operations (i.e. addition, subtraction, multiplication, and division) on complex numbers.		*
2. Sets and Functions		Candidates should be able to:			
2.1	Operations on Sets	2.1.1	identify the sets denoted by N,Z,W,O,P ,Q and by other symbols ;	*	
		2.1.2	identify operation on set ($\cup, \cap, -$ or \setminus, Δ);	*	
		2.1.3	apply the following operations on sets: i. union ii. intersection iii. difference iv. symmetric difference (e.g $A \Delta B = (A \cup B) - (A \cap B)$) v. complement;		*
2.2	Properties of Union and Intersection	2.2.1	describe the following fundamental properties of union and intersection of two or three sets: i. commutative property of union ii. commutative property of intersection iii. associate property of union iv. associate property of intersection v. distributive property of union over intersection vi. distributive property of intersection over union vii. De Morgan's laws;		*
		2.2.2	verify the above mentioned fundamental properties for given sets;		*

NOTES

				K	U	A
2.3	Venn Diagram	2.3.1	draw Venn diagrams to represent: i. union and intersection of sets ii. complement of a set iii. symmetric difference of sets;			*
		2.3.2	draw Venn diagrams to verify: i. commutative laws for union and intersection of sets ii. associative laws for union and intersection of sets iii. distributive laws for union and intersection of set iv. De Morgan's laws;			*
2.4	Ordered Pairs and Cartesian Product	2.4.1	describe ordered pairs and Cartesian product;		*	
		2.4.2	solve related problems;			*
2.5	Binary Relation	2.5.1	describe a binary relation;		*	
		2.5.2	find the domain and range of a binary relation;			*
2.6	Functions	2.6.1	define function;	*		
		2.6.2	illustrate: i. into function ii. one-one function iii. into and one-one function (injective function) iv. onto function (surjective function) v. one-one and onto function (bijective function);		*	
		2.6.3	determine whether a given relation is a function or not;			*
		2.6.4	distinguish between one-one correspondence and one-one function.		*	

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		K	U	A
3. Logarithms		Candidates should be able to:		
3.1	Scientific Notation	3.1.1	convert a number in ordinary form (common form) to scientific notation and vice versa;	*
3.2	Logarithm	3.2.1	explain the meaning of logarithm and exponential form and their relationship with each other (i.e. $a^x = y \Leftrightarrow \log_a y = x, a > 0, y > 0$ and $a \neq 1$);	*
		3.2.2	solve related problems;	*
		3.2.3	find the characteristic and mantissa (by using log table) of common log (logarithm with base 10) of a number;	*
		3.2.4	find the antilog of a number by using table ;	*
3.3	Laws of Logarithm	3.3.1	prove the following laws of logarithm: i. $\log_a (mn) = \log_a m + \log_a n$ ii. $\log_a \left(\frac{m}{n}\right) = \log_a m - \log_a n$ iii. $\log_a m^n = n \log_a m$ iv. $\log_m n = \frac{\log_a m}{\log_a n}$;	*
3.4	Application of Logarithm	3.4.1	apply the laws of logarithm to solve problems.	*

NOTES

			K	U	A
4. Algebraic Expressions and Algebraic Formulae	Candidates should be able to:				
4.1 Algebraic Expressions	4.1.1	define a rational expression as $\frac{p(x)}{q(x)}$ of two polynomials $p(x)$ and $q(x)$, where $q(x)$ is not the zero polynomial;	*		
	4.1.2	discuss whether a given algebraic expression is a i. polynomial or not, ii. rational expression or not;		*	
	4.1.3	describe $\frac{p(x)}{q(x)}$ as a rational expression in its lowest terms;		*	
	4.1.4	simplify a given rational expression to its lowest terms;			*
	4.1.5	solve problems based on the multiplication and division of a rational expressions in its lowest terms;			*
	4.1.6	find the value of an algebraic expression for a given real number;			*
4.2 Algebraic Formulae	4.2.1	derive the formulae: i. $(a+b)^2 + (a-b)^2 = 2(a^2 + b^2)$ ii. $(a+b)^2 - (a-b)^2 = 4ab$ iii. $(a^2 - b^2) = (a-b)(a+b)$;			*
	4.2.2	find the value of $a^2 + b^2$, $a^2 - b^2$, $a + b$, $a - b$ and ab , using the above formulae;			*
	4.2.3	derive the formula $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$;			*
	4.2.4	find the values of $a^2 + b^2 + c^2$, $a + b + c$ and $ab + bc + ca$, when values of any two of these are given in the above formula;			*

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			K	U	A
	4.2.5	derive the formulae: i. $(a+b)^3 = a^3 + 3ab(a+b) + b^3$ ii. $(a-b)^3 = a^3 - 3ab(a-b) - b^3$;			*
	4.2.6	solve problems based on the above formulae;			*
	4.2.7	find the value of $x^3 \pm \frac{1}{x^3}$ when the value of $x \pm \frac{1}{x}$ is given or vice versa;			*
	4.2.8	derive the formulae: i. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$ ii. $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$;			*
	4.2.9	find the continued product by using the above formulae (e.g. $(x+y)(x-y)(x^2 + xy + y^2)(x^2 - xy + y^2)$);			*
4.3	Surds and their Application	4.3.1 describe the surds of second order; 4.3.2 apply the basic operations on surds of second order to rationalize the denominator and evaluate it;		*	*
4.4	Rationalization	4.4.1 rationalize the denominator of real numbers (e.g. $\frac{1}{a+b\sqrt{x}}, \frac{1}{\sqrt{x}+\sqrt{y}}$) and their combinations, where x and y are natural numbers and a and b are integers.			*

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			K	U	A
5. Factorization		Candidates should be able to:			
5.1	Basic Factorization	5.1.1	factorize the expression of the following types: i. $ka + kb + kc$, ii. $ac + ad + bc + bd$, iii. $a^2 \pm 2ab + b^2$ iv. $a^2 - b^2$ v. $a^2 \pm 2ab + b^2 - c^2$;		*
5.2	Factorization	5.2.1	factorize the expression of the following types: i. $a^4 + a^2b^2 + b^4$ or $a^4 + 4b^4$, ii. $ax^2 + bx + c$, iii. $\left\{ \begin{array}{l} a^3 + 3a^2b + 3ab^2 + b^3, \\ a^3 - 3a^2b + 3ab^2 - b^3, \end{array} \right\}$ iv. $a^3 \pm b^3$;		*
5.3	Remainder Theorem and Factor Theorem	5.3.1	apply remainder theorem to find the remainder when a polynomial is divided by a linear polynomial;		*
		5.3.2	define zeros of a polynomial (the value of the variable for which the value of polynomial becomes zero i.e. $P(x) = 0$);		*
		5.3.3	use the concept of zero polynomial;		*
5.4	Factorization of a Cubic Polynomial	5.4.1	apply factor theorem to factorize a cubic polynomial.		*

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			K	U	A
6. Variations		Candidates should be able to:			
6.1	Ratio, Proportions and Variations	6.1.1	define ratio, proportions and variations (direct and inverse);	*	
		6.1.2	calculate 3 rd , 4 th proportional and mean proportional for continued proportion;		*
6.2	Theorems on Proportions	6.2.1	apply theorems of invertendo, alternendo, componendo, dividendo and componendo-dividendo to find proportions;		*
6.3	Joint Variation	6.3.1	describe joint (direct and inverse) variations;		*
		6.3.2	solve problems related to joint variations (up to four quantities) ;		*
6.4	K-Method	6.4.1	use K-Method to prove conditional equalities involving proportions.		*
7. Matrices and Determinants		Candidates should be able to:			
7.1	Introduction to Matrices	7.1.1	define matrix with real entries;	*	
		7.1.2	define: i. rows and columns of a matrix ii. order of a matrix iii. equality of matrices and identify equal matrices;	*	
7.2	Type of Matrices (up to order 3×3)	7.2.1	describe row matrix, column matrix, rectangular matrix, square matrix, zero/null matrix, diagonal matrix, identity matrix , scalar matrix, unit matrix and symmetric matrix;		*
		7.2.2	find the transpose of a matrix;		*

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				K	U	A
7.3	Addition and Subtraction of Matrices (up to order 3×3)	7.3.1 7.3.2 7.3.3 7.3.4 7.3.5	discuss whether the given matrices are conformable for addition/subtraction; find the addition and subtraction of matrices; verify commutative and associate laws under addition; define the additive identity of a matrix; find the additive inverse of a matrix;	*	*	* * *
7.4	Multiplication of Matrices (up to order 2×2)	7.4.1 7.4.2 7.4.3 7.4.4 7.4.5 7.4.6 7.4.7	discuss whether the given matrices are conformable for multiplication; find the multiplication of a matrix by a real number; find the multiplication of two (or three) matrices; verify associative law under multiplication; verify distributive laws; verify with the help of examples that commutative law under multiplication does not hold in general (i.e. $AB \neq BA$); verify with the help of examples that $(AB)^t = B^t A^t$;		*	* * * * *
7.5	Multiplicative Inverse of a Matrix (up to order 2×2)	7.5.1 7.5.2 7.5.3 7.5.4 7.5.5 7.5.6 7.5.7 7.5.8 7.5.9	describe the determinant of a square matrix; calculate the determinant of a matrix; define the singular and non-singular matrix; solve problems related to the singular and non – singular matrix; find the adjoint of a matrix and related problems; define the multiplicative identity of a matrix; find the multiplicative inverse of a non-singular matrix A and verify that $AA^{-1} = I = A^{-1}A$ where I is the multiplicative identity matrix; apply adjoint method to calculate the inverse of a non singular matrix; verify the result $(AB)^{-1} = B^{-1}A^{-1}$ with the help of examples;	*	*	* * * * * *
7.6	Solution of Matrix Equations and Simultaneous Linear Equations	7.6.1 7.6.2	solve matrix equations (e.g. Find A , if $A + \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = 5 \begin{bmatrix} 3 \\ 2 \end{bmatrix}$); solve a system of two linear equations in two unknowns using i. matrix inverse method ii. Cramer's rule.			* *

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			K	U	A	
8. Basic Statistics		Candidates should be able to:				
8.1	Frequency Distribution and Graphs	8.1.1	construct a grouped frequency table;		*	
		8.1.2	draw and interpret bar charts and histograms with equal class intervals;			*
		8.1.3	draw and interpret a frequency curve and a frequency polygon;			*
		8.1.4	draw and interpret a pie-chart;			*
8.2	Cumulative Frequency Distribution	8.2.1	construct a cumulative frequency table;		*	
		8.2.2	draw and interpret a cumulative frequency curve and cumulative frequency polygon;			*
8.3	Measures of Central Tendency	8.3.1	calculate the arithmetic mean , median and mode for ungrouped and grouped data;			*
		8.3.2	estimate the median and mode graphically;			*
		8.3.3	use the properties of arithmetic mean to solve related problems;			*
8.4	Measures of Dispersion	8.4.1	calculate the range, variance and standard deviation.			*
9. Congruent Triangles		Candidates should be able to:				
9.1	Congruent Triangles	9.1.1	<p>apply the following theorems to solve related problems:</p> <p>i. in any correspondence of two triangles, if one side and any two angles of one triangle are congruent to the corresponding side and angles of the other, the two triangles are congruent.</p> <p>ii. if two angles of a triangle are congruent, then the sides opposite to them are also congruent.</p> <p>iii. in a correspondence of two triangles, if three sides of one triangle are congruent to the corresponding three sides of the other, the two triangles are congruent.</p> <p>iv. if in the correspondence of two right-angled triangles, the hypotenuse and one side of one are congruent to the hypotenuse and the corresponding side of the other, then the triangles are congruent.</p>			*

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10. Parallelograms and Triangle		Candidates should be able to:				
10.1	Parallelograms and Triangles	10.1.1	apply the following theorems to solve related problems: <ul style="list-style-type: none"> i. in a parallelogram: <ul style="list-style-type: none"> a. the opposite sides are congruent b. the opposite angles are congruent c. the diagonals bisect each other; ii. if two opposite sides of a quadrilateral are congruent and parallel, it is a parallelogram. iii. the line segment, joining the midpoints of two sides of a triangle, is parallel to the third side and is equal to one half of its length. iv. the medians of a triangle are concurrent and their point of concurrency is the point of trisection of each median. v. if three or more parallel lines make congruent intercepts on a transversal they also intercept congruent segments on any other transversal. 			*
11. Line Bisectors and Angle Bisectors		Candidates should be able to:				
11.1	Line Bisectors and Angle Bisectors	11.1.1	apply the following theorems to solve related problems: <ul style="list-style-type: none"> i. any point on the right bisector of a line segment is equidistant from its end points. ii. any point equidistant from the end points of a line segment is on the right bisector of it. iii. the right bisectors of the sides of a triangle are concurrent. iv. any point on the bisector of an angle is equidistant from its arms v. any point inside an angle, equidistant from its arms, is on the bisector of it. vi. the bisector of the angles of a triangle are concurrent. 			*

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12. Sides and Angles of a Triangle		Candidates should be able to:			
12.1	Sides and Angles of a Triangle	12.1.1	apply the following theorems to solve related problems: <ol style="list-style-type: none"> i. if two sides of a triangle are unequal in length, the longer side has an angle of greater measure opposite to it. ii. if two angles of a triangle are unequal in measure, the side opposite to the greater angle is longer than the side opposite to the smaller angle. iii. the sum of the lengths of any two sides of a triangle is greater than the length of the third side. iv. from a point, out-side a line, the perpendicular is the shortest distance from the point to the line. 		*
13. Application of Ratio and Proportion in Geometrical Theorems		Candidates should be able to:			
13.1	Ratio and Proportion	13.1.1	apply the following theorems to solve related problems: <ol style="list-style-type: none"> i. a line parallel to one side of a triangle, intersecting the other two sides, divides them proportionally. ii. if a line segment intersects the two sides of a triangle in the same ratio then it is parallel to the third side. iii. the internal bisector of an angle of a triangle divides the side opposite to it in the ratio of the length of the sides containing the angle. iv. if two triangles are similar, the measures of their corresponding sides are proportional. 		*

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14. Practical Geometry – Triangles	Candidates should be able to:			
14.1 Construction of Triangles	14.1.1	draw a triangle when:		*
		i. two sides and the included angle are given, ii. one side and two of the angles are given, iii. two of its sides and the angle opposite to one of them (with all the three possibilities) are given;		
	14.1.2	draw:		*
		i. angle bisectors, ii. altitudes, iii. perpendicular bisectors, iv. medians of a given triangle and verify their concurrency.		

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SSC Part-II (Class X)

Topics	Student Learning Outcomes		Cognitive level		
			K	U	A
15. Algebraic Manipulation	Candidates should be able to:				
15.1 Highest Common Factor and Least Common Multiple	15.1.1	find the highest common factor (H.C.F) and the least common multiple(L.C.M) of algebraic expressions;			*
	15.1.2	use factor or division method to determine H.C.F and L.C.M;			*
	15.1.3	apply H.C.F, L.C.M and their relationship in solving problems;			*
15.2 Basic Operations on Algebraic Fractions	15.2.1	simplify fractional expressions or rational expressions involving basic operations of $+$, $-$, \times , \div ;			*
15.3 Square Root of Algebraic Expressions	15.3.1	calculate square root of algebraic expressions by factorization;			*
	15.3.2	calculate square root of algebraic expressions by division.			*
16. Partial Fractions	Candidates should be able to:				
16.1 Proper and Improper Rational Fractions	16.1.1	distinguish between proper and improper rational fractions;		*	
16.2 Resolution of Fraction into Partial Fractions	16.2.1	convert an algebraic fraction into partial fractions when its denominator consists of i. non-repeated linear factors ii. repeated linear factors.			*

NOTES

			K	U	A
17. Linear Equations and Inequalities	Candidates should be able to:				
17.1 Linear Equations	17.1.1	define linear equation in one variable;	*		
	17.1.2	solve linear equation with real coefficients;			*
	17.1.3	convert equations, involving radicals, to simple linear form and find their solutions and its verification;			*
	17.1.4	solve word problems based on linear equation and verify its solutions;			*
17.2 Equations involving Absolute Value	17.2.1	define absolute value;	*		
	17.2.2	solve the equation involving absolute value in one variable;			*
17.3 Linear Inequalities	17.3.1	define inequalities ($>$, $<$) and (\geq , \leq);	*		
	17.3.2	describe the properties of inequalities (i.e. trichotomy, transitive, additive and multiplicative);		*	
17.4 Solving Linear Inequalities	17.4.1	solve linear inequalities with real coefficient, in one variable,			*
	17.4.2	represent the solution of linear inequalities on the number line;		*	
	17.4.3	solve linear inequalities, involving absolute value, in one variable of the following cases on the number line i. $ x < 0$ ii. $ x > 0$ iii. $ x < 1$ iv. $ x > 1$ v. $ x \pm a < 0$, where a is an integer vi. $ x \pm a > 0$, where a is an integer.			*
	17.4.4	represent the solution of the above cases on the number line.		*	

NOTES

		K	U	A
18. Linear Graphs and their Application		Candidates should be able to:		
18.1 Cartesian Plane and Linear Graphs	18.1.1	identify pair of real numbers as an ordered pair;	*	
	18.1.2	describe rectangular or Cartesian plane consisting of two number lines (x -axis and y -axis) intersecting at right angles at the point O(origin);		*
	18.1.3	locate an ordered pair (a, b) as point in the rectangular plane: i. a as the x -coordinate (or abscissa) ii. b as the y -coordinate (or ordinate);		*
	18.1.4	draw different geometrical shapes (e.g., line segment, triangle and rectangle etc) by joining a set of given points;		*
	18.1.5	construct a table for pairs of values satisfying a linear equation in two variables;		*
	18.1.6	draw the graph of a given linear equation: i. $y = mx$ ii. $y = mx + c$ iii. $ax + by + c = 0$;		*
	18.1.7	draw the graph of an equation of the form: i. $y = c$ ii. $x = a$		*
	18.1.8	draw the graph from a given table of discrete values and choose an appropriate scale to draw the graph (to make students realise that every first degree equation does not form a linear equation it may be a point graph);		*
	18.1.9	solve related problems based on the above concepts;		*

NOTES

			K	U	A
18.2 Conversion Graphs	18.2.1	interpret a given graph to develop a relation between quantities corresponding to other quantities;		*	
	18.2.2	use the graph for the conversions of: i. miles and kilometers ii. acres and hectares iii. degree Celsius and degree Fahrenheit iv. Pakistani currency and other currencies (other inter-related quantities);			*
18.3 Solution of Equations in two Variables	18.3.1	solve the simultaneous linear equations in two variables using: i. algebraic method ii. graphical method.			*
19. Quadratic Equations	Candidates should be able to:				
19.1 Quadratic Equation (in one variable)	19.1.1	distinguish between quadratic equation and other equations;		*	
	19.1.2	write quadratic equation in standard form;	*		
19.2 Solution of Quadratic Equations.	19.2.1	solve quadratic equations involving real roots in one variable by : i. factorization ii. completing the square method;			*
19.3 Quadratic Formula	19.3.1	apply completing the square method to derive quadratic formula;			*
	19.3.2	use quadratic formula to solve the quadratic equations involving real and complex roots;			*
	19.3.3	solve word problems based on the quadratic equation and verify and validate solutions (e.g. negative value of dimension is not acceptable);			*

NOTES

			K	U	A
20. Introduction to Coordinate Geometry	Candidates should be able to:				
20.1 Distance Formula	20.1.1	describe coordinate geometry;		*	
	20.1.2	prove distance formula to calculate the distance between two points given in Cartesian plane;		*	
	20.1.3	use distance formula to find the distance between two given points;			*
20.2 Collinear Points	20.2.1	distinguish between collinear and non-collinear points;		*	
	20.2.2	use distance formula to show whether the given points are collinear or non collinear;			*
	20.2.3	apply distance formula to show that the given three non-collinear points may form: i. an equilateral triangle ii. an isosceles triangle iii. a right angled triangle iv. a scalene triangle;			*
	20.2.4	apply the distance formula to show that given four non-collinear points may form: i. a parallelogram ii. a square iii. a rectangle;			*
20.3 Mid-Point Formula	20.3.1	apply the formula to find the midpoint of the line segment joining two given points;			*
	20.3.2	solve problems related to mid point formula.			*

NOTES

			K	U	A
21. Introduction to Trigonometry		Candidates should be able to:			
21.1	Measurement of an Angle	21.1.1	describe sexagesimal system (degree, minute and second);	*	
		21.1.2	convert an angle given in D°M'S" form into a decimal form and vice versa;		*
21.2	Length of Circular Arc	21.2.1	define a radian (measure of an angle in circular system);	*	
		21.2.2	derive $l = r\theta$, where r is the radius of the circle, l is the length of circular arc and θ is the central angle measured in radians;		*
		21.2.3	apply $l = r\theta$ to solve problems;		*
21.3	Trigonometric Ratios	21.3.1	identify quadrants and quadrantal angles;	*	
		21.3.2	calculate the values of trigonometric ratios for 45°, 30°, and 60°;		*
		21.3.3	identify the signs of trigonometric ratios in different quadrants;	*	
21.4	Trigonometric Identities	21.4.1	prove the fundamental trigonometric identities i.e. $\sin^2 \theta + \cos^2 \theta = 1$, $1 + \tan^2 \theta = \sec^2 \theta$, $1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$		*
		21.4.2	apply the above trigonometric identities to prove different trigonometric relations;		*
21.5	Angle of Elevation and Depression	21.5.1	illustrate angle of elevation and depression;		*
		21.5.2	solve problems involving angle of elevation and depression in a right angled triangle.		*
22. Pythagoras' Theorem		Candidates should be able to:			
22.1	Pythagoras' Theorem	22.1.1	apply the following theorems to solve related problems:		*
		i.	in a right-angled triangle, the square of the length to hypotenuse is equal to the sum of the squares of the lengths of the other two sides (Pythagoras' theorem)		
		ii.	if the square of one side of a triangle is equal to the sum of the squares of the other two sides then the triangle is a right angled triangle.		

NOTES

			K	U	A
23. Chords of a Circle		Candidates should be able to:			
23.1	Chords of a Circle	23.1.1	apply the following theorems to solve related problems:		*
			<ul style="list-style-type: none"> i. one and only one circle can pass through three non-collinear points. ii. a straight line drawn from the centre of a circle to bisect a chord which is not a diameter is perpendicular to the chord. iii. perpendicular from the centre of a circle on a chord bisects it. iv. if two chords of a circle are congruent then they will be equidistant from the centre. v. two chords of a circle which are equidistant from the centre are congruent. 		
24. Tangent to a Circle		Candidates should be able to:			
24.1	Tangent to a Circle	24.1.1	apply the following theorems to solve related problems:		*
			<ul style="list-style-type: none"> i. if a line is drawn perpendicular to a radial segment of a circle at its outer end point, it is tangent to the circle at that point. ii. the tangent to a circle and the radial segment joining the point of contact and the centre are perpendicular to each other. iii. the two tangents drawn to a circle from a point outside it are equal in length. iv. if two circles touch externally or internally the distance between their centres is respectively equal to the sum or difference of their radii. 		

NOTES

			K	U	A
25. Chords and Arcs	Candidates should be able to:				
25.1 Chords and Arcs	25.1.1	apply the following theorems to solve related problems: <ol style="list-style-type: none"> i. if two arcs of a circle (or of congruent circles) are congruent then the corresponding chords are equal. ii. if two chords of circle (or of congruent circles) are equal, then their corresponding arcs (minor, major or semi – circular) are congruent. iii. equal chords of a circle (or of congruent circles) subtend equal angles at the centre (at the corresponding centers). iv. if the angles subtended by two chords of a circle (or congruent circles) at the centre (corresponding centers) are equal, the chords are equal. 			*
26. Angle in a Segment of a Circle	Candidates should be able to:				
26.1 Angle in a Segment of a Circle	26.1.1	apply the following theorems to solve related problems: <ol style="list-style-type: none"> i. the measure of a central angle of a minor arc of a circle, is double that of the angle subtended by the corresponding major arc. ii. any two angles in the same segment of a circle are equal. iii. the inscribed angle in a semi circle is a right angle. iv. the angle in a segment greater than a semi circle is less than a right angle. v. the angle in a segment less than a semi circle is greater than right angle. vi. the opposite angles of any quadrilateral inscribed in a circle are supplementary. 			*

NOTES

			K	U	A
27. Practical Geometry - Circles		Candidates should be able to:			
27.1	Construction of Circle	27.1.1	find the centre of a given circle and verify it;		*
		27.1.2	draw a circle passing through three given non – collinear points;		*
27.2	Circles attached to Polygons	27.2.1	draw a circumscribed circle about a given triangle;		*
		27.2.2	draw an inscribed circle in a given triangle;		*
		27.2.3	draw and escribed circle to a given triangle;		*
		27.2.4	draw a circumscribed equilateral triangle about a given circle;		*
		27.2.5	draw an inscribed equilateral triangle in a given circle;		*
		27.2.6	draw a circumscribed square about a given circle;		*
		27.2.7	draw an inscribed square in a given circle;		*
		27.2.8	draw a circumscribed regular hexagon about a given circle;		*
27.3	Tangents to the Circle	27.3.1	draw a tangent to a given circle from a point P when P lies:		*
		27.3.2	i. on the circumference ii. outside the circle; draw: i. direct common tangent or external tangent ii. transverse common tangent or internal tangent to two equal circles iii. transverse common tangent or internal tangent to two unequal circles;		*

NOTES

4. Scheme of Assessment

Class IX

Table 1: Number of Student Learning Outcomes by Cognitive Level

Topic No.	Topics	No. of Sub-topics	SLOs			Total
			K	U	A	
1.	Real and Complex Numbers	6	3	5	6	14
2.	Sets and Functions	6	3	5	7	15
3.	Logarithms	4	0	2	5	7
4.	Algebraic Expressions and Algebraic Formulae	4	1	3	14	18
5.	Factorization	4	1	0	5	6
6.	Variations	4	1	1	4	6
7.	Matrices and Determinants	6	5	4	18	27
8.	Basic Statistics	4	0	2	8	10
9.	Congruent Triangles	1	0	0	1	1
10.	Parallelograms and Triangles	1	0	0	1	1
11.	Line Bisectors and Angle Bisectors	1	0	0	1	1
12.	Sides and Angles of a Triangle	1	0	0	1	1
13.	Application of Ratio and Proportion in Geometrical Theorems	1	0	0	1	1
14.	Practical Geometry-Triangles	1	0	0	2	2
	Total	44	14	22	74	110
	Percentage		13	20	67	100

Table 2: Allocation of Marks for the Multiple Choice Questions (MCQs), and Constructed Response Questions (CRQs)

Topic No.	Topic	No. of Sub-Topics	Marks		Total
			Multiple Choice Questions	Constructed Response Questions	
1.	Real and Complex Numbers	6	4	4	8
2.	Sets and Functions	6	4	4	8
3.	Logarithms	4	2	3	5
4.	Algebraic Expressions and Algebraic Formulae	4	3	4	7
5.	Factorization	4	3	5	8
6.	Variations	4	2	4	6
7.	Matrices and Determinants	6	3	5	8
8.	Basic Statistics	4	3	4	7
9.	Congruent Triangles	1	3	4	7
10.	Parallelograms and Triangles	1			
11.	Line Bisectors and Angle Bisectors	1	3	4	7
12.	Sides and Angles of a Triangle	1			
13.	Application of Ratio and Proportion in Geometrical Theorems	1			
14.	Practical Geometry- Triangles	1	0	4	4
	Total	44	30	45	75

Table 3: Paper Specifications

Topic No.	Topics	Marks Distribution		Total Marks
1.	Real and Complex Numbers	MCQs 4 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		8
2.	Sets and Functions	MCQs 4 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		8
3.	Logarithms	MCQ 2 @ 1 Mark CRQ 1 @ 3 Marks		5
4.	Algebraic Expressions and Algebraic Formulae	MCQs 3 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		7
5.	Factorization	MCQs 3 @ 1 Mark *CRQs 2 @ 5 Marks Choose any ONE from TWO		8
6.	Variations	MCQs 2 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		6
7.	Matrices and Determinants	MCQs 3 @ 1 Mark CRQ 1 @ 5 Marks		8
8.	Basic Statistics	MCQs 3 @ 1 Mark CRQ 1 @ 4 Marks		7
9.	Congruent Triangles	MCQs 3 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		7
10.	Parallelograms and Triangles			
11.	Line Bisectors and Angle Bisectors			
12.	Sides and Angles of a Triangle	MCQs 3 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		7
13.	Application of Ratio and Proportion in Geometrical Theorems			
14.	Practical Geometry-Triangles	CRQ 1 @ 4 Marks		4
	Total Marks	MCQs 30	CRQs 45	75

* There will be TWO questions and candidates will be required to attempt any ONE by making a choice out of the TWO.

Class X

Table 4: Number of Student Learning Outcomes by Cognitive Level

Topic No.	Topics	No. of Sub-topics	SLOs			Total
			K	U	A	
15.	Algebraic Manipulation	3	0	0	6	6
16.	Partial Fractions	2	0	1	1	2
17.	Linear Equations and Inequalities	4	3	3	6	12
18.	Linear Graphs and Their Applications	3	1	4	7	12
19.	Quadratic Equations	3	1	1	4	6
20.	Introduction to Coordinate Geometry	3	0	3	6	9
21.	Introduction to Trigonometry	5	3	3	6	12
22.	Pythagoras' Theorem	1	0	0	1	1
23.	Chords of a Circle	1	0	0	1	1
24.	Tangent to a Circle	1	0	0	1	1
25.	Chords and Arcs	1	0	0	1	1
26.	Angle in a Segment of a Circle	1	0	0	1	1
27.	Practical Geometry–Circles	3	0	0	12	12
	Total	31	8	15	53	76
	Percentage		10	20	70	100

Table 5: Allocation of Marks for the Multiple Choice Questions (MCQs), and Constructed Response Questions (CRQs)

Topic No	Topic	No. of Sub-Topics	Marks		Total
			Multiple Choice Questions	Constructed Response Questions	
15.	Algebraic Manipulation	3	3	5	8
16.	Partial Fractions	2	1	3	4
17.	Linear Equations and Inequalities	4	4	5	9
18.	Linear Graphs and Their Applications	3	3	4	7
19.	Quadratic Equations	3	3	4	7
20.	Introduction to Coordinate Geometry	3	3	3	6
21.	Introduction to Trigonometry	5	4	4	8
22.	Pythagoras' Theorem	1	3	4	7
23.	Chords of a Circle	1	3	4	7
24.	Tangent to a Circle	1			
25.	Chords and Arcs	1			
26.	Angle in a Segment of a Circle	1	3	4	7
27.	Practical Geometry–Circles	3	0	5	5
	Total	31	30	45	75

Table 6: Paper Specifications

Topic No.	Topics	Marks Distribution		Total Marks
15.	Algebraic Manipulation	MCQs 3 @ 1 Mark *CRQs 2 @ 5 Marks each Choose any ONE from TWO		8
16.	Partial Fractions	MCQ 1 @ 1 Mark CRQ 1 @ 3 Marks		4
17.	Linear Equations and Inequalities	MCQs 4 @ 1 Mark *CRQs 2 @ 5 Marks each Choose any ONE from TWO		9
18.	Linear Graphs and their Applications	MCQs 3 @ 1 Mark CRQ 1 @ 4 Marks		7
19.	Quadratic Equations	MCQs 3 @ 1 Mark CRQ 1 @ 4 Marks		7
20.	Introduction to Coordinate Geometry	MCQs 3 @ 1 Mark *CRQs 2 @ 3 Marks each Choose any ONE from TWO		6
21.	Introduction to Trigonometry	MCQs 4 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		8
22.	Pythagoras' Theorem	MCQs 3 @ 1 Mark *CRQs 2 @ 4 Marks each Choose any ONE from TWO		7
23.	Chords of a Circle	MCQs 3 @ 1 Mark CRQ 1 @ 4 Marks		7
24.	Tangent to a Circle			
25.	Chords and Arcs	MCQs 3 @ 1 Mark CRQ 1 @ 4 Marks		7
26.	Angle in a Segment of a Circle			
27.	Practical Geometry–Circles	CRQ 1 @ 5 Marks		5
Total Marks		MCQs 30	CRQs 45	75

* There will be TWO questions and candidates will be required to attempt any ONE by making a choice out of the TWO.

- 4.1 Tables 1 and 4 indicate the number and nature of SLOs in each topic in classes IX and X respectively. This will serve as a guide in the construction of the examination paper. It also indicates that more emphasis has been given to the Understanding (20% in IX and 20% in X), Application and higher order skills (67% in IX and 70% in X) to discourage rote memorization. Tables 1 and 4, however, do not translate directly into marks.
- 4.2 There will be two examinations, one at the end of Class IX and one at the end of Class X.
- 4.3 In each class, the theory paper will be in two parts: paper I and paper II. Both papers will be of duration of 3 hours.

- 4.4 Paper I theory will consist of 30 compulsory, multiple choice questions. These questions will involve four response options.
- 4.5 Paper II theory will carry 45 marks and consist of a number of compulsory, constructed response questions. There will be no choice among the topics in constructed response questions but it may be within the topic.
- 4.6 All constructed response questions will be in a booklet which will also serve as an answer script.

5. Teaching-Learning Approaches and Classroom Activities

- 5.1 As the AKU-EB syllabus focuses on understanding and higher order thinking skills, teachers need to encourage activity and problem-based classroom practices.
- 5.2 The following strategies are recommended:

- Demonstration
- Discussion based teaching
- Inquiry approach
- Specialization/Generalization
- Problem Solving
- Seeking relationship
- Investigation
- Open-ended questions
- Presentations
- Brainstorming
- Group discussion
- Concept building through using and developing low/no cost material

6. Recommended Texts, Reference Materials

Recommended Books

1. Punjab Textbook Board (2007). *Mathematics for Class IX and X*. Lahore: Punjab Textbook Board.
2. Sindh Textbook Board. (2007). *Mathematics for Class IX and X*. Jamshoro: Sindh Textbook Board.

Reference Books

1. Punjab Textbook Board (2007). *Mathematics for Class XI*. Lahore: Punjab Textbook Board.
2. Oxford University Press. *New Syllabus D Mathematics Book 2*. Karachi: Oxford University Press.
3. Oxford University Press. *New Syllabus D Mathematics Book 3*. Karachi: Oxford University Press.
4. Oxford University Press. *New Syllabus D Mathematics addendum Book 4*. Karachi: Oxford University Press.

Recommended Websites

A+Math	http://www.aplusmath.com/
AAA Math	http://www.aaamath.com/
Academic Info-Mathematics	http://www.academicinfo.net/math.html
Algebra Buster	http://www.algebra-online.com/
Algebra Helper	http://www.algebrahelp.com/index.jsp
Class Zone	http://www.classzone.com/math_middle.cfm
Click on Bricks	http://kathyschrock.net/clickonbricks/index2.htm
Cool Math	http://www.coolmath.com/
Discovery School (Mathematics)	http://school.discovery.com/lessonplans/math.html
Frank Potter's Science Gems- Mathematics	http://www.sciencegems.com/math.html
Funbrain	http://www.funbrain.com/numbers.html
Geometry	http://www.mathleague.com/help/geometry/geometry.htm
Internet Mathematics Library	http://www.mathforum.org/library
MAPLE	http://www.maplesoft.com
Math Archives	http://www.archives.math.utk.edu/
Math Glossary	http://www.harcourtschool.com/glossary/math_advantage
Math Goodies	http://www.mathgoodies.com
Math World	http://www.mathworld.wolfram.com
Math2	http://www.math2.org/
MATHEMATICA	http://www.wolfram.com/products/mathematica/index.htm
Mathematical Interactivities	http://mathematics.hellam.net/
MathStories	http://www.mathstorie.com
Mega Mathematics	http://www.c3.lanl.gov/mega-math/
Purplemath	http://www.purplemath.com/internet.htm
S.O.S. Mathematics	http://www.sosmath.com
Superkids Educational Software Review	http://www.superkids.com/aweb/tools/math/index.shtml
Teaching madeEasier	http://www.teachingmadeasier.com/math.html
The MathWorks (MATLAB)	http://www.mathworks.com
Webmath	http://www.webmath.com/

7. Definition of Cognitive Levels and Command Words

7.1 Definition of Cognitive Levels

Knowledge

This requires knowing and remembering facts and figures, vocabulary and contexts, and the ability to recall key ideas, concepts, trends, sequences, categories, etc. It can be taught and evaluated through questions based on: who, when, where, what, list, define, identify, label, tabulate, quote, name, state, etc.

Understanding

This requires understanding information, grasping meaning, interpreting facts, comparing, contrasting, grouping, inferring causes/reasons, seeing patterns, organizing parts, making links, summarizing, identifying motives, finding evidence, etc. It can be taught and evaluated through questions based on: why, how, show, demonstrate, paraphrase, interpret, summarize, explain, prove, predict, compare, distinguish, discuss, chart the course/direction, report, etc.

Application

This requires using information or concepts in new situations, solving problems, organizing information and ideas, using old ideas to create new ones, generalizing from given facts, analyzing relationships, relating knowledge from several areas, drawing conclusions, evaluating worth, etc. It can be taught and evaluated through questions based on: differentiate, analyze, show relationship, propose an alternative, prioritize, give reasons for, categorize, corroborate, compare and contrast, create, design, solve, formulate, integrate, rearrange, reconstruct/recreate, reorganize, predict consequences, etc.

7.2 Definition of Command Words

Knowledge

- Define:** Only a formal statement or equivalent paraphrase is required. No examples need to be given.
- Identify:** Pick out, recognizing specified information from a given content or situation.
- Write:** To compose or produce in words, characters or figures.

Understanding

- Construct:** To set in order or something formulated or built systematically or frame a concept, model, or schematic idea.
- Describe:** To state in words (using diagrams where appropriate) the main points of the topic.
- Discuss:** To give a critical account of the points involved in the topic.
- Distinguish:** To identify those characteristics which always or sometimes distinguish between two categories.
- Explain:** To give reason or use some reference to theory, depending on the context.
- Illustrate:** To give clear examples to state, clarify or synthesize a point of view.
- Interpret:** To translate information from observation, charts, tables, graphs, and written material in a supportable manner.
- Locate:** To place or to set in a particular spot or position.
- Prove:** To establish a rule or law by using an accepted sequence of procedures on statements.
- Represent:** To indicate by signs or symbols or to establish a mapping (of mathematical elements or sets)

Application

- Apply:** To use the available information in different contexts to relate and draw conclusions.
- Calculate:** Is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved.
- Convert:** To change or adapt from one system or units to another.
- Derive:** To arrive at a general formula by calculating step by step.
- Determine:** To establish or ascertain definitely, as after consideration, investigation, or calculation
- Draw:** To make a simple freehand sketch or diagram. Care should be taken with proportions and the clear labelling of parts.

- Estimate:** To calculate approximately (the amount, extent, magnitude, position, or value of something).
- Factorize:** To resolve or break integers or polynomials into factors.
- Find:** Is a general term that may variously be interpreted as calculate, measure, determine, etc.
In other contexts, describe and give an account of should be interpreted more generally, i.e. the candidate has greater discretion about the nature and the organization of the material to be included in the answer. Describe and explain may be coupled in a similar way to state and explain.
- Rationalize:** The simplification of an expression or equation by eliminating radicals without changing the value of the expression or the roots of the equation.
- Simplify:** To reduce (an equation, fraction, etc.) to a simple form by cancellation of common factors, regrouping of terms in the same variables, etc.
- Solve:** To work out systematically the answer of a given problem.
- Use:** To deploy the required attribute in a constructed response.
- Verify:** To check or determine the correctness and accuracy of Laws or rules by investigation.

SSC Scheme of Studies³

AKU-EB as a national board offers SSC and HSSC qualifications for both English and Urdu medium schools. The revised SSC Scheme of Studies issued by the Curriculum Wing was implemented from September 2007. Accordingly, each SSC subject will be taught across both the classes IX and X. The Science and Humanities group subjects are offered at SSC level. The marks allocated to subjects in the revised National Scheme of Studies of September 2007 have been followed.

SSC I and II (Class IX and X) subjects on offer for examination

SSC Part-I (Class IX) Science Group

Subjects	Marks			Medium
	Theory	Practical	Total	
English Compulsory-I	75	-	75	English
Urdu Compulsory-I OR Urdu Aasan ^a OR History and Geography of Pakistan-I ^b	75	-	75	Urdu Urdu English
Islamiyat-I OR Ethics-I ^c	*30	-	*30	English / Urdu
Pakistan Studies-I	*45	-	*45	English / Urdu
Mathematics-I	75	-	75	English / Urdu
Physics-I	65	10	75	English / Urdu
Chemistry-I	65	10	75	English / Urdu
Biology-I OR Computer Science-I	65	10	75	English / Urdu English
Total:	*495	30	*525	

SSC Part-II (Class X) Science Group

Subjects	Marks			Medium
	Theory	Practical	Total	
English Compulsory-II	75	-	75	English
Urdu Compulsory-II OR Sindhi ^a OR History and Geography of Pakistan-II ^b	75	-	75	Urdu Sindhi English
Islamiyat-II OR Ethics-II ^c	*45	-	*45	English / Urdu
Pakistan Studies-II	*30	-	*30	English / Urdu
Mathematics-II	75	-	75	English / Urdu
Physics-II	65	10	75	English / Urdu
Chemistry-II	65	10	75	English / Urdu
Biology-II OR Computer Science-II	65	10	75	English / Urdu English
Total:	*495	30	*525	

- a. Candidates from the province of Sindh may appear in "Urdu Aasan" in SSC Part I and in "Sindhi" in Part II examination.
- b. Foreign students may opt HISTORY and GEOGRAPHY OF PAKISTAN in lieu of Urdu Compulsory, subject to the Board's approval.
- c. For non-Muslim candidates only.
- * The above will be implemented in
SSC Part I 2013 Examinations and onwards
SSC Part II 2014 Examinations and onwards

³ Government of Pakistan September 2007. *Scheme of Studies for SSC and HSSC (Classes IX-XII)*. Islamabad: Ministry of Education, Curriculum Wing.

SSC Part-I (Class IX) Humanities Group

Subjects	Marks	Medium
English Compulsory-I	75	English
Urdu Compulsory-I OR Urdu Aasan ^a OR History and Geography of Pakistan-I ^b	75	Urdu Urdu English
Islamiyat-I OR Ethics-I ^c	*30	English / Urdu
Pakistan Studies-I	*45	English / Urdu
General Mathematics-I	75	English / Urdu
Any three of the following Elective Subjects	225 (75 each)	
1. **Geography-I		English / Urdu
2. General Science-I		English / Urdu
3. Computer Science-I (65+10 practical)		English
4. Economics-I		English / Urdu
5. Civics-I		English / Urdu
6. **History of Pakistan-I		English / Urdu
7. **Elements of Home Economics-I		English / Urdu
8. **Food and Nutrition-I (65+10 practical)		English / Urdu
9. **Art & Model Drawing-I		English
10. **Business Studies-I		English
11. **Environmental Studies-I		English
Total:	*525	

SSC Part-II (Class X) Humanities Group

Subjects	Marks	Medium
English Compulsory-II	75	English
Urdu Compulsory-II OR Sindhi ^a History and Geography of Pakistan-II ^b OR	75	Urdu Sindhi English
Islamiyat-II OR Ethics-II ^c	*45	English / Urdu
Pakistan Studies-II	*30	English / Urdu
General Mathematics-II	75	English / Urdu
Any three of the following Elective Subjects	225 (75 each)	
1. **Geography-II		English / Urdu
2. General Science-II		English / Urdu
3. Computer Science-II (65+10 practical)		English
4. Economics-II		English / Urdu
5. Civics-II		English / Urdu
6. **History of Pakistan-II		English / Urdu
7. **Elements of Home Economics-II		English / Urdu
8. **Food and Nutrition-II (65+10 practical)		English / Urdu
9. **Art & Model Drawing-II		English
10. **Business Studies-II		English
11. **Environmental Studies-II		English
Total:	*525	

SSC Part-I and Part-II (Class IX-X) (Additional Subjects)

SSC Part I	SSC Part II	Marks	Medium
1. **Literature in English-I ^d	1. **Literature in English-II ^d	75 each	English
2. **Commercial Geography-I ^d	2. **Commercial Geography-II ^d		English
3. **Additional Mathematics-I ^d	3. **Additional Mathematics-II ^d		English

a. Candidates from the province of Sindh may appear in "Urdu Aasan" in SSC Part I and in "Sindhi" in Part II examination.

b. Foreign students may opt HISTORY and GEOGRAPHY OF PAKISTAN in lieu of Urdu Compulsory, subject to the Board's approval.

c. For non-Muslim candidates only.

d. Subject will be offered as Additional Subject.

* The above will be implemented in

SSC Part I 2013 Examinations and onwards

SSC Part II 2014 Examinations and onwards

****These subjects are offered ONLY in the May examination.**