ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

Higher Secondary School Certificate
(HSSC)

Examination Syllabus

Mathematics
XI

Based on Revised Provincial Curriculum (Sindh)

You can approach us:

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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,

Shahbaz Nasim
Head – Measurement & Testing
Ziauddin University Examination Board

Reviewed by:
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Rationale For The Reviewed Provincial Curriculum

The process of revising the National Curriculum 2006 began in August 2004, when the newly elected government of Pakistan initiated education reforms across the country. These reforms included the introduction of a new National Education Policy, a National Education Census, and a revision of curricula (Ministry of Education, 2009).

In practice, the overhaul of the secondary school curriculum began in 2006, leading to a review of the scheme of studies for classes I to XII and the revision of curricula for 25 compulsory subjects.

The 18th Amendment to the Constitution of Pakistan, enacted in 2010, significantly altered the federal- provincial relationship by abolishing the "concurrent legislative list." This amendment granted provinces greater legislative and financial autonomy in sectors such as education and health. The most notable implication of the 18th Amendment for education was the transfer of responsibility for curriculum development, syllabus planning, policy formation, and educational standards to the provinces, marking a significant step forward for education.

In Sindh, the School Education Department tasked a Curriculum Review Team with revising the National Curriculum 2006 for all subjects. The goal was to create a curriculum better suited to the needs of students and teachers while aligning with the principles of the 18th Amendment. Subject-specific curriculum review committees were established to critically examine and align the curriculum's content, both contextually and textually, ensuring coherence across various subjects. The Bureau of Curriculum (BoC) played a crucial role in organizing workshops and meetings in Hyderabad to facilitate the completion of this task. The support of numerous educationists, researchers, and teachers was invaluable in successfully revising the curriculum.

The revised National Curriculum, along with the original version, is available on the DCAR website at https://dcar.gos.pk/Sindh-Curriculum/Curriculum%20for%20Mathematics%20Grades%20XI-XII%20(Revised%20in%202019).pdf for easy access.

The Ziauddin University Examination Board (ZUEB) SSC and HSSC syllabi are developed in accordance with the Sindh Revised Curriculum. To date, textbooks for various subjects have been developed based on the revised curriculum.

ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

CURRICULUM FOR MATHEMATICS, GRADE XI

UNIT 1 COMPLEX NUMBERS

Unit	Student Learning Outcome: Students will be able to:	K	U	A
1.1 Complex Numbers & Geometrical Representation	1.1.1 Recall complex number z=a+ibz=a+ib or (a,b)(a,b), with i=−1i=\sqrt{-1}.	✓		
	1.1.2 Recognize real part (a) and imaginary part (b).		✓	
	1.1.3 Know the condition for equality of complex numbers.	✓		
	1.1.4 Carry out basic operations on complex numbers.			✓
	1.1.5 Define conjugate z¯=a−ib\overline{z}=a-ib.	✓		
	1.1.6 Define $\|z\| = \sqrt{a^2 + b^2}$ as the absolute value or modulus of a complex number $z = a + ib$.			✓
	1.1.7 Represent zz geometrically as (a,b)(a,b).		✓	
	1.1.8 Order relation of complex numbers.		✓	
	1.1.9 Vector representation of complex numbers.		✓	
1.2 Properties of Complex Numbers	1.2.1 Describe algebraic properties (commutative, associative, distributive).		✓	

Unit	Student Learning Outcome: Students will be able to:	K	U	A
	1.2.2 Know additive and multiplicative identity.	✓		
	1.2.3 Find additive and multiplicative inverse.			✓
	1.2.4 Demonstrate the following properties. $\|z\| = \|-z\| = \|\bar{z}\| = \|-\bar{z}\|$, $\bar{\bar{z}} = z$, $z\bar{z} = \|z\|^2$, $\overline{z_1 + z_2} = \bar{z}_1 + \bar{z}_2$ Triangle inequality of complex numbers $\overline{z_1 z_2} = \bar{z}_1 \bar{z}_2$, $\overline{\left(\frac{z_1}{z_2}\right)} = \frac{\bar{z}_1}{\bar{z}_2}$, $z_{2 \neq 0}$			✓
	1.2.5 Find real and imaginary parts of the following type of complex numbers $(x + iy)^n$ $\left(\frac{x_1 + iy_1}{x_2 + iy_2}\right)^n$, $x_2 + iy_2 \neq 0$ Where n = ± 1, and ± 2			✓
1.3 Solution of Complex Equations	1.3.1 Solve simultaneous linear equations with complex coefficients.			✓
	1.3.2 Factorize polynomials into linear factors.			✓
	1.3.3 Solve quadratic equations with complex roots by completing the square where p, q and r are real numbers and z a complex number.			✓

UNIT 2 MATRICES AND DETERMINANTS

Unit	Student Learning Outcome: Students will be able to:	K	U	A
2.1 Matrices	2.1.1 Recall the concepts of matrix notation, order, and equality of matrices.	✓		
	2.1.2 Identify special matrices: row, column, square, rectangular, zero/null, identity, scalar, diagonal.	✓		
	2.1.3 Define upper and lower triangular matrices, transpose, symmetric, skew-symmetric, idempotent, nilpotent, involuntary, periodic, Hermitian, and skew-Hermitian matrices (order ≤ 4).	✓		
2.2 Algebra of Matrices	2.2.1 Perform scalar multiplication, addition, subtraction, and multiplication of matrices (up to 3×3, real or complex entries).			✓
	2.2.2 Show that matrix addition is commutative (A+B=B+AA+B=B+A) but multiplication is not commutative in general.		✓	
	2.2.3 Verify the transpose property (AB)T=BTAT(AB)^T = B^T A^T for 3×3 matrices.			✓
2.3 Determinants	2.3.1 Describe determinants of square matrices, minors, and cofactors.	✓		
	2.3.2 Evaluate determinants using cofactor expansion.			✓
	2.3.3 Define singular and non-singular matrices.	✓		
	2.3.4 Describe the adjoint of a square matrix and of a diagonal matrix.	✓		
	2.3.5 Use the adjoint method to calculate and verify the inverse of a square matrix.			✓
	2.3.6 Verify that (AB)−1=B−1A−1(AB)^{-1}=B^{-1}A^{-1}.			✓
2.4 Properties of Determinants	2.4.1 State and verify properties of determinants (row/column interchange, scalar multiplication, etc.).		✓	
	2.4.2 Evaluate determinants without expansion using determinant properties.			✓
2.5 Row and Column Operations	2.5.1 Describe elementary row and column operations.	✓		
	2.5.2 Define echelon and reduced echelon form of a matrix.	✓		
	2.5.3 Reduce a matrix to echelon and reduced echelon forms.			✓
	2.5.4 Recognize and determine the rank of a matrix.			✓

Unit	Student Learning Outcome: Students will be able to:	K	U	A
	2.5.5 Use row operations to find the inverse and rank of a matrix.			✓
2.6 Solving System of Linear Equations	2.6.1 Distinguish between homogeneous and non-homogeneous systems of linear equations (2 or 3 unknowns).		✓	
	2.6.2 Solve a system of three homogeneous linear equations in three unknowns.			✓
	2.6.3 Define consistent and inconsistent systems of linear equations and demonstrate with examples.		✓	
	2.6.4 Solve 3×3 non-homogeneous systems using: (a) matrix inversion method, (b) Cramer's rule, (c) Gauss elimination, (d) Gauss–Jordan elimination.			✓

UNIT 3 VECTORS

Unit	Student Learning Outcome: Students will be able to:	K	U	A
3.1 Vectors in Plane	3.1.1 Define a scalar and a vector.	✓		
	3.1.2 Give geometrical representation of a vector.		✓	
	3.1.3 Define (geometrically): magnitude, equal vectors, negative, unit, zero vector, position vector, parallel vectors, addition/subtraction, triangle/parallelogram/polygon laws, scalar multiplication.	✓		
	3.1.4 Represent a vector in Cartesian plane using unit vectors i, j.		✓	
	3.1.5 Recognize the above definitions using analytical representation.		✓	
	3.1.6 Find a unit vector in the direction of another given vector.			✓
	3.1.7 Find the position vector of a point dividing a line segment in a given ratio.			✓
	3.1.8 Use vectors to prove simple theorems of descriptive geometry.			✓
3.2 Vectors in Space	3.2.1 Recognize rectangular coordinate system in 3D space.	✓		
	3.2.2 Define unit vectors i, j, k.	✓		
	3.2.3 Recognize components of a vector.	✓		
	3.2.4 Give analytic representation of a vector.		✓	
	3.2.5 Find magnitude of a vector.			✓
	3.2.6 Extend all plane vector definitions (3.1) to space vectors.		✓	
3.3 Properties of Vector Addition	3.3.1 State and prove commutative and associative laws of vector addition.		✓	
	3.3.2 Prove identity property (0 as additive identity) and inverse property (-A as additive inverse).		✓	
3.4 Properties of Scalar Multiplication	3.4.1 State and verify: commutative, associative, and distributive laws of scalar multiplication.		✓	
	3.4.2 Prove that m(a⃗±b⃗)=ma⃗±mb⃗m(\vec{a} \pm \vec{b}) = m\vec{a} \pm m\vec{b}.		✓	
3.5 Dot / Scalar Product	3.5.1 Define dot product of two vectors and give its geometrical interpretation.	✓		
	3.5.2 Prove: i·i=j·j=k·k=1i\cdot i = j\cdot j = k\cdot k = 1;		✓	

	$i\cdot j=j\cdot k=k\cdot i=0$i\cdot j = j\cdot k = k\cdot i = 0.			
	3.5.3 Express dot product in terms of components.		✓	
	3.5.4 Find condition for orthogonality of two vectors.		✓	
	3.5.5 Prove commutative and distributive laws for dot product.		✓	
	3.5.6 Explain direction cosines and direction ratios of a vector.		✓	
	3.5.7 Prove that sum of squares of direction cosines equals 1.		✓	
	3.5.8 Use dot product to find angle between two vectors.			✓
	3.5.9 Find projection of one vector along another.			✓
	3.5.10 Compute work done by a constant force along a displacement vector.			✓
	3.5.11 Solve real-life problems involving work done.			✓
3.6 Cross / Vector Product	3.6.1 Define cross product of two vectors and give geometrical interpretation.	✓		
	3.6.2 Prove standard vector identities: $i\times i=j\times j=k\times k=0$i\times i=j\times j=k\times k=0; $i\times j=-j\times i=k$i\times j=-j\times i=k; $j\times k=i$j\times k=i; $k\times i=j$k\times i=j.		✓	
	3.6.3 Express cross product in terms of components.		✓	
	3.6.4 Prove that the magnitude of **A x B** represents the area of a parallelogram with adjacent sides **A** and **B**.			✓
	3.6.5 Find condition for parallelism of two non-zero vectors.		✓	
	3.6.6 Prove $A\times B=-B\times A$A\times B = -B\times A.		✓	
	3.6.7 Prove distributive law of cross product.		✓	
	3.6.8 Use cross product to find angle between two vectors.			✓
	3.6.9 Find vector moment of a force about a point.			✓
	3.6.10 Solve real-life problems involving torque / vector moment.			✓
3.7 Scalar Triple Product	3.7.1 Define scalar triple product.	✓		
	3.7.2 Express scalar triple product in determinantal form.		✓	
	3.7.3 Prove identities: $i\cdot(j\times k)=j\cdot(k\times i)=k\cdot(i\times j)=1$i\cdot(j\times k)=j\cdot(k\times i)=k\cdot(i\times j)=1; $i\cdot(k\times j)=j\cdot(i\times k)=k\cdot(j\times i)=-1$i\cdot(k\times j)=j\cdot(i\times k)=k\cdot(j\times i)=-1.		✓	

	3.7.4 Prove dot and cross are interchangeable in scalar triple product.		✓	
	3.7.5 Find volume of a parallelepiped and tetrahedron determined by three vectors.			✓
	3.7.6 Define coplanar vectors and find condition for coplanariry of three vectors.		✓	

UNIT 4 SEQUENCES AND SERIES

Unit	Student Learning Outcome: Students will be able to:	K	U	A
4.1 Sequence	4.1.1 Define a sequence (progression) and its terms.	✓		
	4.1.2 Recognize that a sequence can be constructed from a formula or an inductive definition.		✓	
	4.1.3 Recognize triangular, factorial, and Pascal sequences in fractional form.	✓		
4.2 Arithmetic Sequence	4.2.1 Define an arithmetic sequence.	✓		
	4.2.2 Find the nth or general term of an arithmetic sequence.			✓
	4.2.3 Solve problems involving arithmetic sequences.			✓
4.3 Arithmetic Mean	4.3.1 Know the arithmetic mean between two numbers.	✓		
	4.3.2 Insert an arithmetic mean between two numbers.			✓
	4.3.3 Insert nn arithmetic means between two numbers.			✓
4.4 Arithmetic Series	4.4.1 Define an arithmetic series.	✓		
	4.4.2 Establish the formula for the sum of first nn terms of an arithmetic series.		✓	
	4.4.3 Show that the sum of nn arithmetic means between two numbers equals nn times their arithmetic mean.		✓	
	4.4.4 Solve real-life problems involving arithmetic series.			✓
4.5 Geometric Sequence	4.5.1 Define a geometric sequence.	✓		
	4.5.2 Find the nth or general term of a geometric sequence.			✓
	4.5.3 Solve problems involving geometric sequences.			✓
4.6 Geometric Mean	4.6.1 Know the geometric mean between two numbers.	✓		
	4.6.2 Insert a geometric mean between two numbers.			✓
	4.6.3 Insert nn geometric means between two numbers.			✓
4.7 Geometric Series	4.7.1 Define a geometric series.	✓		
	4.7.2 Find the sum of first nn terms of a geometric series.			✓
	4.7.3 Find the sum of an infinite geometric series.			✓
	4.7.4 Convert a recurring decimal into an equivalent fraction using geometric series.			✓

Unit	Student Learning Outcome: Students will be able to:	K	U	A
	4.7.5 Solve real-life problems involving geometric series.			✓
4.8 Harmonic Sequence	4.8.1 Recognize a harmonic sequence.	✓		
	4.8.2 Find the nth term of a harmonic sequence.			✓
4.9 Harmonic Mean	4.9.1 Define the harmonic mean.	✓		
	4.9.2 Insert a harmonic mean between two numbers.			✓
	4.9.3 Insert nn harmonic means between two numbers.			✓

UNIT 5 MISCELLANEOUS SERIES

Unit	Student Learning Outcome: Students will be able to:	K	U	A
5.1 Evaluation of $\sum n$, $\sum n^2$, $\sum n^3$	5.1.1 Recognize sigma (∑) notation.	✓		
	5.1.2 Find the sum of the first nn natural numbers (∑n)(\sum n).			✓
	5.1.3 Find the sum of the squares of the first nn natural numbers (∑n2)(\sum n^2).			✓
	5.1.4 Find the sum of the cubes of the first nn natural numbers (∑n3)(\sum n^3).			✓
5.2 Arithmetico-Geometric Series	5.2.1 Define an arithmetico-geometric series.	✓		
	5.2.2 Find the sum of nn terms of an arithmetico-geometric series.			✓
5.3 Method of Differences	5.3.1 Define the method of differences.	✓		
	5.3.2 Apply this method to find the sum of nn terms of a series whose differences of consecutive terms are in arithmetic or geometric sequence.			✓
5.4 Summation using Partial Fractions	5.4.1 Use partial fractions to find the sum to nn terms of a series of the type 1a(a+d)+1(a+d)(a+2d)+…\tfrac{1}{a(a+d)} + \tfrac{1}{(a+d)(a+2d)} + \dots.			✓
	5.4.2 Use partial fractions to find the sum to infinity of the above type of series.			✓

UNIT 6 PERMUTATION, COMBINATION AND PROBABILITY

Unit	Student Learning Outcome: Students will be able to:	K	U	A
6.1 Factorial of a Natural Number	6.1.1 Know Kramp's factorial notation to express the product of first nn natural numbers by n!n!.	✓		
6.2 Permutation	6.2.1 Recognize the fundamental principle of counting and illustrate it using a tree diagram.			✓
	6.2.2 Explain the meaning of permutation of nn different objects taken rr at a time and know the notation nPrnP_r.		✓	
	6.2.3 Prove that nPr=n(n−1)(n−2)...(n−r+1)nP_r = n(n-1)(n-2)...(n-r+1) and deduce: nPr=n!(n−r)!, nPn=n!, 0!=1nP_r = \tfrac{n!}{(n-r)!},\ nP_n=n!,\ 0!=1.		✓	
	6.2.4 Apply nPrnP_r to solve problems of finding the number of arrangements of nn objects (all distinct or some alike).			✓
	6.2.5 Find the arrangement of different objects around a circular permutation.			✓
	6.2.6 Solve daily life problems involving permutation.			✓
6.3 Combination	6.3.1 Define the combination of nn different objects taken rr at a time.	✓		
	6.3.2 Prove the formula nCr=n!r!(n−r)!nC_r = \tfrac{n!}{r!(n-r)!} and deduce its results: • nCn=nC0=1nC_n=nC_0=1 • nCr=nCn−rnC_r=nC_{n-r}, nC1=nCn−1=nnC_1=nC_{n-1}=n • nCr+nCr−1=(n+1)CrnC_r+nC_{r-1}=(n+1)C_r.		✓	
	6.3.3 Solve daily life problems involving combination.			✓
6.4 Probability	6.4.1 Define: statistical experiment, sample space, event, mutually exclusive events, equally likely events, dependent/independent events, exhaustive event, impossible event, simple and compound events.	✓		
	6.4.2 Recognize the formula for probability of occurrence of an event P(E)=n(E)n(S),0≤P(E)≤1P(E) = \tfrac{n(E)}{n(S)}, 0 \leq P(E) \leq 1.	✓		
	6.4.3 Apply the formula for finding probability in simple cases.			✓
	6.4.4 Use Venn diagrams and tree diagrams to find probability of events.			✓
	6.4.5 Define conditional probability.	✓		
	6.4.6 Recognize and deduce the addition theorem: P(A∪B)=P(A)+P(B)−P(A∩B)P(A∪B) = P(A)+P(B)-P(A∩B), and for mutually exclusive events		✓	

	$P(A \cup B)=P(A)+P(B)P(A \cup B) = P(A)+P(B)$.			
	i) Recognize the multiplication theorem (or law) of probability $P(A \cap B) = P(A)P(B \mid A)$ or $P(A \cap B) = P(B)P(A \mid B)$ where $P(B \mid A)$ and $P(A \mid B)$ are conditional probabilities. Deduce that $P(A \cap B) = P(A)P(B)$ where A and B are independent events.	✓		
	6.4.8 Use theorems of addition and multiplication of probability to solve daily life problems.			✓

UNIT 7 MATHEMATICAL INDUCTION AND BINOMIAL THEOREM

Unit	Student Learning Outcome: Students will be able to:	K	U	A
7.1 Mathematical Induction	7.1.1 Describe the principle of mathematical induction.	✓		
	7.1.2 Apply the principle to prove statements, identities, or formulae.			✓
7.2 Binomial Theorem	7.2.1 Use Pascal's triangle to find the expansion of (x+y)n(x+y)^n where nn is a small positive integer.			✓
	7.2.2 State and prove the binomial theorem for a positive integral index.		✓	
	7.2.3 Expand (x+y)n(x+y)^n using the binomial theorem and find its general term.			✓
	7.2.4 Find a specified term in the expansion of (x+y)n(x+y)^n.			✓
7.3 Binomial Series	7.3.1 Expand (1+x)n(1+x)^n where nn is a positive integer, and extend this result for all rational values of nn.		✓	
	7.3.2 Expand $(1 + x)^n$ in ascending power of x and explain its validity/convergence for $\| x \| < 1$ where n is a rational number.		✓	
	7.3.3 Determine approximate values of binomial expansions with indices as negative integers or fractions.			✓
	7.3.4 Apply binomial expansions in summation and series.			✓

UNIT 8 FUNCTIONS AND GRAPHS

Unit	Student Learning Outcome: Students will be able to:	K	U	A
8.1 Function	8.1.1 Recall: • function as a rule of correspondence, • domain, co-domain and range of a function, • one-to-one and onto functions.	✓		
	8.1.2 Know linear, quadratic, and square root functions.	✓		
8.2 Inverse Function	8.2.1 Define inverse functions and demonstrate their domain and range with examples.		✓	
8.3 Graphical Representation	8.3.1 Sketch graphs of: • linear functions (y=ax+b), • non-linear functions ($y=x^2$), • square function ($x^2+y^2=a^2$).			✓
	8.3.2 Sketch the graph of y=xny=x^n where n is: • a positive integer, • a negative integer ($x\neq0$), • a rational number (x>0).			✓
	8.3.3 Sketch graph of quadratic function y=ax2+bx+cy=ax^2+bx+c where a≠0a≠0, b,cb,c are integers.			✓
	8.3.4 Sketch graphs using factors.			✓
	8.3.5 Predict functions from their graphs (e.g. find equation of f(x)=ax2+bx+cf(x)=ax^2+bx+c given two x-intercepts and a third point).			✓
8.4 Intersecting Graphs	8.4.1 Find intersection points graphically between: • a linear function and coordinate axes, • two linear functions, • a linear and quadratic function.			✓
	8.4.2 Solve daily life problems graphically.			✓

UNIT 9 LINEAR PROGRAMMING

Unit	Student Learning Outcome: Students will be able to:	K	U	A
9.1 Introduction	9.1.1 Define linear programming (LP) as planning the allocation of limited resources to obtain an optimal result.	✓		
9.2 Linear Inequalities	9.2.1 Find algebraic solutions of linear inequalities in one variable and represent them on a number line.			✓
	9.2.2 Interpret graphically linear inequalities in two variables.			✓
	9.2.3 Determine graphically the region bounded by up to three simultaneous linear inequalities of non-negative variables and shade the feasible region.			✓
9.3 Feasible Region	9.3.1 Define: • linear programming problem, • objective function, • problem constraints, • decision variables.	✓		
	9.3.2 Define and show graphically the feasible region (solution space) of an LP problem.		✓	
	9.3.3 Identify the feasible region of simple LP problems.			✓
9.4 Optimal Solution	9.4.1 Define optimal solution of an LP problem.	✓		
	9.4.2 Find the optimal solution (graphical method) through systematic procedure: • formulate LP problem, • construct the graph, • identify feasible region, • locate solution points, • evaluate objective function, • select optimal solution, • verify by substitution.			✓
	9.4.3 Solve real-life simple LP problems.			✓

UNIT 10 TRIGONOMETRIC IDENTITIES OF SUM AND DIFFERENCE OF ANGLES

Unit	Student Learning Outcome: Students will be able to:	K	U	A
10.1 Fundamental Law of Trigonometry	10.1.1 Recall trigonometric ratios.	✓		
	10.1.2 Use distance formula to establish fundamental law of trigonometry: • $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$ Deduce: • $\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ • $\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$ • $\tan(\alpha \pm \beta) = (\tan\alpha \pm \tan\beta) / (1 \mp \tan\alpha\tan\beta)$.			✓
10.2 Trigonometric Ratios of Allied Angles	10.2.1 Define allied angles.	✓		
	10.2.2 Use fundamental law and its deductions to derive trigonometric ratios of allied angles.		✓	
	10.2.3 Express $a\cdot\sin\theta + b\cdot\cos\theta$ in the form $r\cdot\sin(\theta+Ø)$, where $a = r\cdot\cos Ø$ and $b = r\cdot\sin Ø$.			✓
10.3 Double, Half and Triple Angle Identities	10.3.1 Derive double-angle, half-angle, and triple-angle identities from fundamental law and its deductions.			✓
10.4 Sum, Difference and Product of sine and cosine	10.4.1 Express the product of sines and cosines as sums or differences of sines and cosines.			✓
	10.4.2 Express the sums or differences of sines and cosines as products of sines and cosines.			✓

UNIT 11 APPLICATION OF TRIGONOMETRY

Unit	Student Learning Outcome: Students will be able to:	K	U	A
11.1 Solving Triangles	11.1.1 Solve right-angled triangle when measures of two sides are given.			✓
	11.1.2 Solve right-angled triangle when one side and one angle are given.			✓
	11.1.3 Define an oblique triangle and prove: • law of cosines • law of sines • law of tangents Deduce respective half-angle formulae.		✓	
	11.1.4 Apply above laws to solve oblique triangles.			✓
11.2 Area of a Triangle	11.2.1 Derive formulae to find the area of a triangle in terms of: • two sides and their included angle • one side and two angles • three sides (Heron's formula).			✓
11.3 Circles Connected with Triangle	11.3.1 Define circum-circle, in-circle, and escribed-circle.	✓		
	11.3.2 Derive formulae to find circum-radius, in-radius, and escribed-radii.		✓	
	11.3.3 Apply derived results to deduce different identities.			✓

UNIT 12 GRAPHS OF TRIGONOMETRIC AND INVERSE TRIGONOMETRIC FUNCTIONS AND SOLUTION OF TRIGONOMETRIC EQUATIONS

Unit	Student Learning Outcome: Students will be able to:	K	U	A
12.1 Period of Trigonometric Functions	12.1.1 Find the domain and range of the trigonometric functions.		✓	
	12.1.2 Define even and odd functions.	✓		
	12.1.3 Discuss periodicity of trigonometric functions and find max/min values of functions of the form: • $a + b\sin\theta$ • $a + b\cos\theta$ • $a + b\sin(c\theta+d)$ • $a + b\cos(c\theta+d)$ • reciprocals of above.			✓
12.2 Graphs of Trigonometric Functions	12.2.1 Recognize the shapes of the graphs of sine, cosine, and tangent for all angles.	✓		
	12.2.2 Draw the graphs of the six basic trigonometric functions within -2π to 2π.			✓
	12.2.3 Predict the graphs of $\sin^2\theta$, $\cos^2\theta$, $\sin\theta\cos\theta$, etc., without actual drawing.		✓	
	12.2.4 Define periodic, even/odd, and translation properties of $\sin\theta$, $\cos\theta$, and $\tan\theta$.		✓	
	12.2.5 Deduce $\sin(\theta + 2k\pi) = \sin\theta$ where $k \in Z$.		✓	
12.3 Solving Trigonometric Equations Graphically	12.3.1 Solve equations of type $\sin\theta = k$, $\cos\theta = k$, $\tan\theta = k$ using periodic, even/odd, and translation properties.			✓
	12.3.2 Solve graphically equations of type: • $\sin\theta = \theta/2$ • $\cos\theta = \theta/2$ • $\tan2\theta = 2\theta$, for $-\pi \leq \theta \leq \pi$			✓
12.4 Inverse Trigonometric Functions	12.4.1 Define inverse trigonometric functions and their domain and range.	✓		
	12.4.2 Find domains and ranges of principal trigonometric and inverse trigonometric functions.		✓	
	12.4.3 Draw the graphs of inverse trigonometric functions.			✓
	12.4.4 Prove the addition and subtraction formulae of inverse trigonometric functions.		✓	
	12.4.5 Apply addition and subtraction formulae of inverse trigonometric functions to verify identities.			✓

12.5 Solving General Trigonometric Equations	12.5.1 Solve trigonometric equations and check roots by substitution to discard extraneous roots.			✓
	12.5.2 Use the periods of trigonometric functions to solve general trigonometric equations.			✓

Ziauddin University Examination Board

Scheme of Assessment

Mathematics XI

Maximum marks: 100

Section "A"

Multiple Choice Questions (MCQs) **(20 x 1 = 20)**
Attempt 20 MCQs. Each MCQ carries equal marks.

Section "B"

Short Answer Questions **(10 x 4 = 40)**
Attempt any 10 out of 14 questions. Each question carries equal marks.

Section "C"

Detailed Answer Questions **(5 x 8= 40)**
Attempt any 5 out of 8 questions. Each question carries equal marks.

Ziauddin University Examination Board
Table of Specification [TOS]
Mathematics XI

S.No	Domains	Weightage in evaluation 100%	MCQs 1 mark each	Short Answers 4 marks each	Detailed Answers 8 marks each
1	Complex Numbers	7%	2	1	0
2	Matrices and Determinants	10%	2	1	1
3	Vectors	10%	2	1	1
4	Sequences and Series	12%	2	2	1
5	Miscellaneous Series	5%	1	1	0
6	Permutation, Combination and Probability	7%	2	1	0
7	Mathematical Induction and Binomial Theorem	12%	2	2	1
8	Functions and Graphs	10%	2	1	1
9	Linear Programming	7%	2	1	0
10	Trigonometric Identities of Sum & Difference of Angles	7%	1	1	1
11	Application of Trigonometry	7%	1	1	1
12	Graphs of Trigonometric and Inverse Trigonometric Functions and Solution of Trigonometric Equations	7%	1	1	1
Total # of Questions asked			**20**	**14**	**8**
Total # of Questions to be attempted			**20**	**10**	**5**
Maximum marks attainable			**20 marks**	**40 marks**	**40 marks**

DEFINITIONS OF COGNITIVE LEVELS

Remember

Remembering is the act of retrieving knowledge and can be used to produce things like definitions or lists. The student must be able to recall or recognise information and concepts. The teacher must present information about a subject to the student, ask questions that require the student to recall that information and provide written or verbal assessment that can be answered by remembering the information learnt.

Question Stems

- Can you name all the …?
- Describe what happens when …?
- How is (are) …?
- How would you define …?
- How would you identify …?
- How would you outline …?
- How would you recognise…?
- List the … in order.
- What do you remember about …?
- What does it mean?
- What happened after?
- What is (are) …?
- What is the best one?
- What would you choose …?
- When did …?
- Where is (are) …?
- Which one …?
- Who spoke to …?
- Who was …?
- Why did …?

Understand

The next level in the taxonomic structure is Understanding, which is defined as the construction of meaning and relationships. Here the student must understand the main idea of material heard, viewed, or read and interpret or summarise the ideas in their own words. The teacher must ask questions that the student can answer in their own words by identifying the main idea.

Question Stems

- Can you clarify…?
- Can you illustrate …?
- Condense this paragraph.
- Contrast …
- Does everyone think in the way that … does?
- Elaborate on …
- Explain why …
- Give an example
- How can you describe...?
- How would you clarify the meaning...?
- How would you compare …?
- How would you differentiate between …?
- How would you describe…?
- How would you generalise…?
- How would you identify …?
- Is it valid that …?
- Is this the same as …?
- Outline …
- Select the best definition...
- State in your own words...
- This represents …
- What are they saying?
- What can you infer from …?
- What can you say about …?
- What could have happened next?
- What did you observe?

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What does this mean?
What expectations are there?
What information can you infer from…?
What is the main idea of …?
What restrictions would you add?
What seems likely?
What seems to be …?
What would happen if …?
What might happen if …?
Which are the facts?
Which statements support …?

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Apply

The third level in Bloom’s taxonomy, Applying, marks a fundamental shift from the pre-Bloom’s learning era because it involves remembering what has been learnt, having a good understanding of the knowledge, and applying it to real-world exercises, challenges or situations. Students must apply an abstract idea in a concrete case to solve a problem or relate it to prior experience. The teacher must provide opportunities for students to use theories and problem-solving techniques in new situations and review and check their work. Assessment questions should be provided that allow students to define and solve problems.

Question Stems

Can you group by characteristics such as …?
Choose the best statements that apply...
Clarify why …
Do you know of another instance where …?
Draw a story map...
Explain why a character acted in the way that he did...
From the information given, can you develop a set of instructions about …?
How would you develop …?
How would you change …?
How would you demonstrate…?

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Analyse

Analysing is the cognitive level where students can take the knowledge they have remembered, understood and applied, then delve into that knowledge to make associations, discernments or comparisons. Students should break down a concept or idea into parts and show relationships between these parts. Teachers must give students time to examine concepts and their requisite elements. Students are required to explain why they chose a solution.

Question Stems

Can you distinguish between …?
Can you explain what must have happened when …?
Determine the point of view, bias, values, or intent underlying the presented material...
Discuss the pros and cons of …
How can you classify … according to …?
How can you compare the different parts?
How can you sort the different parts…?
How is … connected to …?
How is … similar to …?
How would you categorise…?
How would you explain...?

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• How would you develop? • How would you explain …? • How would you modify …? • How would you present…? • How would you solve … ? • Identify the results of … • Illustrate the … • Judge the effects of … What would result …? • Predict what would happen if … • Tell how much change there would be if … • Tell what would happen if … • What actions would you take to perform …? • What do you think could have happened next? • What examples can you find that ? • What other way would you choose to …? • What questions would you ask of …? • What was the main idea …? • What would the result be if …? • Which factors would you change if …? • Who do you think…? • Why does this work? • Write a brief outline … • Write in your own words …	• What could the ending have been if ... had taken place? • State the point of view of … • What are some of the problems of …? • What assumptions …? • What can you infer about…? • What can you point out about ? • What conclusions …? • What do you see as other possible outcomes? • What does the author assume? • What explanation do you have for …? • What ideas justify the conclusion? • What ideas validate…? • What is the analysis of …? • What is the function of …? • What is the problem with …? • What motive is there? • What persuasive technique is used? • What statement is relevant? • What was the turning point? • What were some of the motives behind …? • What's fact? Opinion? • What's the main idea? • What's the relationship between? • Which events could not have happened? • Why did … changes occur? • Why do you think ?

BLOOM'S TAXONOMY WITH EXAMPLES

Conclusion

If you are a teacher looking for ways to engage your students in learning, this LIST of questions might be interesting for your classroom practice. Bloom's Taxonomy question stems can help elicit higher-order thinking skills and promote critical thinking among learners at different taxonomy levels. These question stems can also encourage students to think about their knowledge through reflection before answering questions.

ACTION WORDS FOR COGNITIVE LEVELS

Knowledge	Understand	Apply	Analyze	Evaluate	Create
					
define	explain	solve	analyze	reframe	design
identify	describe	apply	appraise	criticize	compose
describe	interpret	illustrate	judge	evaluate	create
label	paraphrase	modify	support	order	plan
list	summarize	use	compare	compare	combine
name	classify	calculate	decide	classify	formulate
state	compare	change	discriminate	contrast	invent
match	differentiate	choose	recommend	distinguish	hypothesize
recognize	discuss	demonstrate	summarize	infer	substitute
select	distinguish	discover	assess	separate	write
examine	extend	experiment	choose	explain	compile
locate	predict	relate	convince	select	construct
memorize	associate	show	defend	categorize	develop
quote	contrast	sketch	estimate	connect	generalize
recall	convert	complete	grade	differentiate	integrate
reproduce	demonstrate	construct	measure	divide	modify
tabulate	estimate	dramatize	predict	order	organize
tell	express	interpret	rank	prioritize	prepare
Copy	identify	manipulate	score	survey	produce

discover	indicate	paint	select	calculate	rearrange
duplicate	infer	prepare	test	conclude	rewrite
enumerate	relate	teach	argue	correlate	adapt
listen	restate	act	conclude	deduce	anticipate
observe	select	collect	consider	devise	arrange
omit	translate	compute	critique	diagram	assemble
read	ask	explain	debate	dissect	choose
recite	cite	list	distinguish	estimate	collaborate
record	discover	operate	editorialize	evaluate	facilitate
repeat	generalize	practice	justify	experiment	imagine
retell	group	simulate	persuade	focus	intervene
visualize	illustrate	transfer	rate	illustrate	make
	judge	write	weigh	organize	manage
	observe			outline	originate
	order			plan	propose
	report			question	simulate
	represent			test	solve
	research				support
	review				test
	rewrite				validate
	show				

HSSC PART I EXAMINATION
MARKS BREAKUP GRID FOR EXAMINATION 2025

GROUP: PRE-MEDICAL

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
BIOLOGY	85	15	100
TOTAL	505	45	550

GROUP: PRE-ENGINEERING

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
PHYSICS	85	15	100
CHEMISTRY	85	15	100
MATHEMATICS	100	--	100
TOTAL	520	30	550

GROUP: GENERAL SCIENCE

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
PHYSICS	85	15	100
COMPUTER SCIENCE	75	25	100
MATHEMATICS	100	--	100
TOTAL	510	40	550

GROUP: COMMERCE

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
ECONOMICS	75	-	75
P.O.C	75	-	75
ACCOUNTING	100	--	100
BUSINESS MATHEMATICS	50		50
TOTAL	550	---	550

GROUP: HUMANITIES

(Any Three Electives)

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
COMPUTER SCIENCE	75	25	100
ISLAMIC STUDIES	100		100
MATHEMATICS	100	-	100
SOCIOLOGY	100	--	100
ECONOMICS	100		100
EDUCATION	100		100
CIVICS	100		100
NURSING	85	15	100
TOTAL	550	---	550

GROUP: MEDICAL TECHNOLOGY

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
MICROBIOLOGY	85	15	100
HEMATOLOGY & BLOOD BANKING	85	15	100
ANATOMY & PHYSIOLOGY	85	15	100
TOTAL	505	45	550

GROUP: PRE-NURSING

SUBJECT	THEORY	PBA	TOTAL
ENGLISH	100	-	100
URDU NORMAL / URDU EASY	100	-	100
ISLAMIYAT / ETHICS	50	-	50
BIO-CHEMISTRY	85	15	100
FUNDAMENTALS OF NURSING	85	15	100
ELEMENTARY ANATOMY & MICRO TECHNIQUE	85	15	100
TOTAL	505	45	550