



ZIAUDDIN UNIVERSITY
EXAMINATION BOARD

**Higher Secondary School
Certificate (HSSC)**

Examination syllabus

**Bio-Chemistry
XI**

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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,

Beena Kohati-Bilal
Academic Head – Curriculum Development & Training
Ziauddin University Examination Board

Acknowledgement

The Pre-Nursing syllabus has been meticulously developed in alignment with the DCAR (Directorate of Curriculum, Assessment, and Research) Scheme of Studies, ensuring its relevance to contemporary educational standards while enhancing its authenticity and wider acceptance within the academic and healthcare communities. The collective efforts of the faculty members of Ziauddin University Faculty of Nursing — Ms. Fatima Ali Jawad, Ms. Anisa Bhimani, Ms. Aiman Siddiqui, Mr. Kaleem Sarfaraz, and Ms. Iqra Qureshi — with their expertise and dedication, have been instrumental in shaping this curriculum that aligns with both academic and professional standards.

We would also like to extend our heartfelt thanks to the Dean – Ms. Pamela Marshall, Principal – Ms. Sumaira Punjwanu, and Advisor – Ms. Yasmin Noorani Amarsi, College of Nursing, for their collective leadership, guidance, and unwavering support throughout the curriculum development process.

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 http://dcar.gos.pk/BoC_Other_Pages/curriculum_dev.html 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.

AIMS AND OBJECTIVES:

Aims of the Bio-Chemistry Course

- Provide a comprehensive understanding of the chemical principles that govern biological systems and processes.
- Enable students to explore the molecular basis of life, emphasizing the structure, function, and interactions of biomolecules.
- Develop a strong foundation in the biochemical pathways that sustain cellular and systemic functions.
- Prepare students for advanced studies in medical, biological, and chemical sciences by fostering analytical and problem-solving skills.
- Promote an appreciation for the application of biochemistry in understanding health, disease, and therapeutic interventions.
- Encourage the development of critical thinking skills and the ability to apply biochemical knowledge in practical and clinical contexts.

Objectives of the Bio-Chemistry Course

- Identify and describe the structure, function, and properties of essential biomolecules, including carbohydrates, lipids, proteins, and nucleic acids.
- Explain the principles of enzymology, including enzyme kinetics, mechanisms, and regulation.
- Understand and analyze metabolic pathways, such as glycolysis, the citric acid cycle, oxidative phosphorylation, and lipid metabolism, and their roles in energy production and storage.
- Describe the structure and function of DNA and RNA, emphasizing their role in replication, transcription, and translation.
- Understand biochemical signaling mechanisms, including hormone action and cell communication.
- Recognize the importance of bioenergetics and the role of ATP in linking catabolism and anabolism.
- Explain the biochemical basis of diseases, such as metabolic disorders and the role of biomolecules in pathophysiology.

- Apply biochemical principles to laboratory techniques, including chromatography, spectrophotometry, and electrophoresis.
- Analyze the role of cofactors, vitamins, and minerals in enzymatic and metabolic processes.
- Evaluate the impact of environmental and nutritional factors on biochemical processes and health.
- Demonstrate knowledge of molecular biology techniques and their applications in research and diagnostics.
- Interpret biochemical data to solve problems and make informed decisions in practical and clinical settings.
- Integrate biochemical knowledge to understand the relationship between structure and function at the molecular and cellular levels.

ZIAUDDIN UNIVERSITY EXAMINATION BOARD
XI – BIO-CHEMISTRY
SLOs CATEGORIZATION
Detailed Syllabus

Unit Title	SLO	Description	K	U	A
1. Basic Concepts of Chemistry	1.1	Review the basic concepts of matter, elements, mixtures, compounds, chemical reactions, equations & bonding	✓		
	1.2	Discuss acid-base and redox reactions		✓	
2. Basic Concepts of Organic Chemistry	2.1	Recognize the importance of organic compounds	✓		
	2.2	Compare properties of organic and inorganic compounds		✓	
	2.3	Describe the classification of organic compounds	✓		
	2.4	Differentiate the type of hydrocarbons <ul style="list-style-type: none"> • Saturated • Unsaturated 		✓	
	2.5	Describe the molecular composition of carbohydrates, fats, proteins, nucleic acids	✓		
	2.6	List the functional groups	✓		
	2.7	Write equations for the formation of various compounds			✓
	2.8	Discuss the biological importance of various compounds		✓	
	2.9	Distinguish between primary, secondary, and tertiary amines		✓	
	2.10	Explain the structure of amino acids		✓	
	2.11	Discuss isomerism with at least two examples		✓	
3. Metabolism	3.1	Define metabolism, anabolism, catabolism	✓		
	3.2	Define ATP and discuss its relationship with catabolism and anabolism		✓	
	3.3	Define terms like gluconeogenesis, glycogenesis, etc.	✓		
	3.4	Briefly discuss the metabolic pathways for carbohydrates, proteins, and fats		✓	
4. Chemistry of Carbohydrates	4.1	Define carbohydrates	✓		
	4.2	Describe the general structure of carbohydrates	✓		
	4.3	Explain the classification of carbohydrates		✓	
	4.4	Compare major classes of carbohydrates		✓	
	4.5	Discuss the biological significance of carbohydrates		✓	
5.	5.1	Describe the structure and general properties of lipids	✓		
	5.2	Discuss the classification of lipids		✓	

Unit Title	SLO	Description	K	U	A
Chemistry of Lipids	5.3	Differentiate between saturated and unsaturated fats		✓	
	5.4	Differentiate between soap and detergents		✓	
	5.5	Explain the role of phospholipids in cell membranes		✓	
	5.6	Describe the role of steroids (cholesterol)	✓		
6. Chemistry of Proteins	6.1	Discuss the general structure of amino acids		✓	
	6.2	Discuss essential/non-essential amino acids, polar/non polar amino acids, and zwitter ions		✓	
	6.3	Describe classification of proteins	✓		
	6.4	Explain the significance of protein denaturation		✓	
	6.5	Discuss the structure of dipeptides and tripeptides		✓	
	6.6	Describe primary, secondary, tertiary, and quaternary structures of proteins	✓		
7. Nucleic Acid & Nucleotide	7.1	Describe the main structural features of nucleotide	✓		
	7.2	Explain the structure of RNA & DNA		✓	
	7.3	State the main differences between DNA & RNA	✓		
	7.4	Discuss the biological importance of nucleotides		✓	
8. Enzymology	8.1	Discuss the importance of enzymes		✓	
	8.2	Explain the mode of enzyme activity		✓	
	8.3	Distinguish between apoenzymes, coenzymes, cofactors		✓	
	8.4	Distinguish between activators and inhibitors		✓	
	8.5	Understand enzyme inhibition <ul style="list-style-type: none"> • Competitive inhibitors • Non-competitive inhibitors • Uncompetitive inhibition 		✓	
	8.6	Describe classification of enzymes	✓		
	8.7	Discuss the clinical significance of enzymes		✓	
	8.8	Explain the factors affecting enzyme activity		✓	
9. Bioenergetics and Metabolism	9.1	Define bioenergetics	✓		
	9.2	Briefly discuss the concept of free energy		✓	
	9.3	Explain the role of ATP in linking catabolism & anabolism		✓	
	9.4	Discuss biological oxidation and reduction		✓	
	9.5	Describe the electron transport chain & oxidative phosphorylation	✓		
10. Metabolism of Carbohydrates	10.1	Discuss the importance of glucose in blood and its dependency by various tissues		✓	
	10.2	Discuss glycogenesis and glycogenolysis		✓	

Unit Title	SLO	Description	K	U	A
	10.3	Describe the role of oxidative glucose catabolism in the citric acid cycle	✓		
	10.4	Describe the role of gluconeogenesis	✓		
	10.5	Discuss the overall scheme of carbohydrate metabolism		✓	
11. Metabolism	11.1.1	Describe the mechanism of fatty acid oxidation	✓		
	11.1.2	Discuss the amount of energy produced during oxidation of fat		✓	
	11.1.3	Explain the significance of the role of ketone bodies		✓	
	11.2.1	Review the digestion and absorption of protein	✓		
	11.2.2	Explain the significance of nitrogen balance		✓	
	11.2.3	Describe the synthesis of protein	✓		
	11.2.4	Discuss transamination, deamination, and decarboxylation		✓	
	11.2.5	Discuss the formation of urea and ammonia disposal		✓	
12. Hormones	12.1	Describe the classification of hormones	✓		
	12.2	Discuss the mode of function of steroid & peptide hormones		✓	
	12.3	Become familiar with cardiac, pineal, and gastrointestinal hormones		✓	

ZIAUDDIN UNIVERSITY EXAMINATION BOARD**XI – BIO-CHEMISTRY****Number of SLOs by Cognitive Levels**

S. No	Unit Name	K	U	A	Total SLOs
1	Basic Concepts of Chemistry	1	1	0	2
2	Basic Concepts of Organic Chemistry	4	6	1	11
3	Metabolism	2	2	0	4
4	Chemistry of Carbohydrates	2	3	0	5
5	Chemistry of Lipids	2	4	0	6
6	Chemistry of Proteins	2	4	0	6
7	Nucleic Acid & Nucleotide	2	2	0	4
8	Enzymology	2	6	0	8
9	Bioenergetics and Metabolism	2	3	0	5
10	Metabolism of Carbohydrates	2	3	0	5
11	Metabolism	3	5	0	8
12	Hormones	1	2	0	3
Total		25	41	1	67
Percentage		37	61	2	100

**ZIAUDDIN UNIVERSITY EXAMINATION BOARD
XI – BIO-CHEMISTRY**

Table of Specifications (TOS)

S. No	Unit Name	Weightage in Evaluation	MCQ	PBA	CRQ	ERQ
1	Basic Concepts of Chemistry	5%	1	1	1	0
2	Basic Concepts of Organic Chemistry	12%	2	2	2	0
3	Metabolism	7%	1	1	1	0
4	Chemistry of Carbohydrates	8%	1	1	1	0
5	Chemistry of Lipids	8%	2	2	1	0
6	Chemistry of Proteins	10%	2	2	1	1
7	Nucleic Acid & Nucleotide	7%	1	1	1	0
8	Enzymology	12%	2	2	2	0
9	Bioenergetics and Metabolism	8%	1	1	1	1
10	Metabolism of Carbohydrates	10%	2	1	2	0
11	Metabolism	8%	1	1	1	1
12	Hormones	5%	1	0	1	1
Total		100%	17	15	15	4

ZIAUDDIN UNIVERSITY EXAMINATION BOARD
XI – BIO-CHEMISTRY
SKILLS (Lab Work)

1. Test the presence of reducing sugars
2. Effect of concentration of reducing sugar on the result of Benedict's Test
3. Investigate the presence of starch in various food products
4. Investigate the presence of fats or lipids in various food products
5. Investigate the presence of protein in the given food products
6. Interpret the level of ALT or SGPT in the given blood specimen
7. Interpret the level of BUN in the given blood specimen

ZIAUDDIN UNIVERSITY EXAMINATION BOARD
XI – BIO-CHEMISTRY
EQUIPMENT REQUIRED

1. Test Tubes
2. Pipettes
3. Beaker
4. De-ionized water
5. Benedict's solution
6. Glucose solution
7. Bunsen burner
8. Iodine solution
9. Grease
10. Torch
11. Paper
12. Copper Sulphate
13. Caustic Soda
14. Dropper
15. Food products (as per the need of the experiment)

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?

	<ul style="list-style-type: none"> • 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 would happen if ...? • Which are the facts? • Which statements support ...?
<p>Apply</p> <p>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.</p> <p>Question Stems</p> <ul style="list-style-type: none"> • 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 could you develop ...? • How would you change ...? • How would you demonstrate...? • How would you develop ... to present ? • How would you explain ...? 	<p>Analyse</p> <p>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.</p> <p>Question Stems</p> <ul style="list-style-type: none"> • 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 ? • If ... happened, what might the ending have been? • State the point of view of ... • What are some of the problems of ...?

- 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 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				