INTERNATIONAL HIGHER SCHOOL OF MEDICINE

Department of Fundamental disciplines

SYLLABUS

Biochemistry

2026-2027 academic year

for students of medical faculty

1 course 1 semester, groups 1- 40

3 credits (90 h, including auditorial - 54 h, independent work – 36 h)

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Venue: **Educational and Morphological Center**
Lev Tolstoy street 114/1
Room № 301,303,304,102,003.

The Syllabus is considered

at the meeting of Fundamental Disciplines Department

Protocol № 1 dated 07.09.2026

Head of the department Dzh.N. Abdullaev

Course objective: The purpose of mastering the academic discipline "Biochemistry" is to master the fundamentals of classical and modern biochemistry; formation of skills and abilities to work with biochemical equipment, setting up a biochemical experiment and analyzing clinical biochemical parameters for making a preliminary diagnosis based on it.
After study of the discipline the student must:
Knowledge: Students should understand the structure and metabolic pathways of key biomolecules in health and disease, the integration and regulation of these pathways, diagnostically important metabolites in tissues and fluids, as well as the principles of laboratory equipment and the basics of modeling biochemical experiments.
Skill: Students should be able to search, analyze, evaluate, and apply knowledge to solve professional tasks while effectively using key laboratory equipment in biomedical research.
Attitude: Students should possess a solid medical and biological conceptual framework, along with biochemical thinking skills, and be proficient in basic biochemical laboratory methods applied in clinical practice.
Pre-requisites: Chemical and biological disciplines of the school educational program.
Post-requisites: Pathology, pharmacology, internal medicine, pediatric diseases and medical genetics.

THEMATIC PLAN OF LECTURES

№	Theme of lecture	Hours	Date
1	Introduction to biochemistry. Organization of the cell. Biomolecules. Transport of substances across membranes into extracellular fluid.	2	05.10.26-10.10.26 12.10.26-17.10.26
2	Amyloidosis. Neurodegenerative dementias due to amyloids.	2	19.10.26-24.10.26 26.10.26-31.10.26
3	Structure, functions and disorders of Immunoglobulins. HIV and AIDS.	2	02.11.26-07.11.26 09.11.26-14.11.26
4	General characteristics and classification of enzymes. Regulation of enzymatic activity.	2	16.11.26-21.11.26 23.11.26-28.11.26
5	Clinical enzymology.	2	30.11.26-05.12.26 07.12.26-12.12.26
6	Vitamins in human nutrition. Biological role of dietary fibers.	2	14.12.26-19.12.26 21.12.26-26.12.26
7	Minerals in human nutrition: functions, sources, metabolism, and disorders. pH, water, and electrolyte balance.	2	28.12.26-02.01.27 04.01.27-09.01.27
8	Metabolism and hormonal control.	2	11.01.27-16.01.27 18.01.27-23.01.27
9	Mechanism of hormone's action. Pathological mechanism of endocrine diseases control	2	23.01.27-30.01.27 01.02.27-06.02.27
10	**Clinical training**		08.02.27-13.02.27
Total		**18**	

THEMATIC PLAN OF THE PRACTICAL CLASSES

№	Theme of practical class	Hours	Date
1	Amino acids and proteins: structural organization, classification. Nutritional and metabolic significance.	2	05.10.26 -10.10.26
2	Clinical aspects of proteins. Protein energy malnutrition (PEM).	2	12.10.26-17.10.26
3	Introduction to biochemical laboratory. Quantitative reactions for amino acids and proteins. Precipitation & denaturation of proteins.	2	19.10.26-24.10.26
4	Methods of laboratory manual techniques: colorimetry, spectrometry. Determination of plasma proteins.	2	26.10.26-31.10.26
5	Characteristics of individual plasma proteins.	2	02.11.26-07.11.26
6	Components of adaptive immune system.	2	09.11.26-14.11.26
7	Extracellular matrix (ECM) functions in health and disease; protein targeting, sorting, and related disorders.	2	16.11.26-21.11.26
8	Hemoglobin and hemoglobinopathy.	2	23.11.26-28.11.26
9	**Assessment #1**	2	30.11.26-05.12.26
10	Enzymes: Factors affecting enzyme activity.	2	07.12.26-12.12.26
11	Inhibitors and activators of enzymes in clinical use.	2	14.12.26-19.12.26
12	Investigation of oxidoreductase and hydrolase action & factors affecting enzyme's activities.	2	21.12.26-26.12.26
13	**Assessment #2**	2	28.12.26-02.01.27
14	Fat-soluble vitamins.	2	04.01.27-09.01.27
15	Water-soluble vitamins: hematopoietic vitamins.	2	11.01.27-16.01.27
16	Water- soluble vitamins: energy-releasing vitamins.	2	18.01.27-23.01.27
17	Methods of laboratory manual technique: Titration (direct; reverse): Determination of vitamin C in food.	2	23.01.27-30.01.27
18	**Assessment #3**	2	01.02.27-06.02.27
19	**Clinical training**		08.02.27-13.02.27
	Total	**36**	

THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS

Unit №	Theme of independent work	Hours	Date
Organization of the cell. Proteins	1) work with educational literature;	2	5.10.26 - 05.12.26
	2) individual assignments (PBL)	2	
	3) Lab.w. "Paper chromatography"	2	
	Total	6	
Enzyme. Clinical enzymology.	1) work with tasks on the platform "Proceum" on the topic "Enzymes. Clinical enzymology";	4	07.12.26-02.01.27
	2) work with educational literature;	10	
	3) individual assignments (PBL)	2	
	4) Lab.w. "Determination of blood aspartate aminotransferase"	2	
	Total	18	
Vitamins and minerals in human nutrition. Metabolism and hormonal control	1) work with tasks on the platform "Proceum" on the topic "Nutrition";	2	04.01.27–06.02.27
	2) work with educational literature;	6	
	3) individual assignments (PBL)	2	
	4) Lab.w. "Determination of iron in the blood"	2	
	Total	12	

Recommended reading for the discipline:
1. Basic:

1. Biochemistry. 6th ed. Satyanaryana U. 2021
2. Textbook of Biochemistry. 9th ed.Vasudevan D.M. 2019
3. Lippincott's Iliustrated Reviews: Biochemistry. 7th ed. Ferrier D.R. 2017
4. Biochemistry. 5th ed. Satyanaryana U. 2017
5. Textbook of Biochemistry. 4th ed. DM Vasudevan. 2016
6. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015
7. Viva in Anatomy, Physiology, & Biochemistry. 2nd ed. Anjula Vij. 2015
8. Biochemistry Practical Book. Mukhamedova I. 2010

2. Additional:

1. Textbook of Biochemistry. 8th ed. Vasudevan D.M. 2016
2. Biochemistry. 4th ed. Satyanaryana U. 2011
3. Lippincott's Illustrated Reviews: Biochemistry. Champe P.C. 2005
4. Textbook of Medical Biochemistry. 8th ed. Chatterjea M.N. 2012

Grading policy and procedures for all types of work
For the period of studying the discipline, the student gains points for the relevant parameters (per unit):
current score - 40 points
independent work - 20 points
control score (final assessment of knowledge per unit)- 40 points
Maximum score: 100 = (40 + 20 + 40)
Grading system for student's achievements

Grading criteria per discipline				
Maximum score	Intervals			
	«Unsatisfactory»	«Satisfactory»	«Good»	«Excellent»
Current and Final control work (module) -40	0-23	24-30	31-35	36-40
Consistency and completeness of knowledge in relation to the objects under study	Possesses partial and scattered knowledge, logically unrelated	Possesses a minimum set of knowledge necessary for a systematic approach to the object under study	Possesses a set of knowledge sufficient for a systematic approach to the object under study	Possesses complete knowledge and a systematic view of the object under study
Scientific understanding of the studied phenomenon, process, object	Cannot draw scientifically correct conclusions from available information	Able to analyze some of the available information	Able to carry out a systematic and scientifically correct analysis of the information provided	Involves new data relevant to the task in the analysis, offers new perspectives on the task
Mastering standard algorithms for solving professional problems	Able to solve only fragments of the task in accordance with the given algorithm	Able to solve the task in accordance with the given algorithm	Understands the basics of the proposed algorithm and solves the problem in accordance with it	Understands the basics of the proposed algorithm and offers new solutions within the framework of the task
Mastering the technique of a laboratory experiment	Did not master the proposed algorithm of the laboratory experiment and its design	Carries out an experiment in accordance with the proposed algorithm, but makes mistakes in presenting the results	Conducts an experiment in accordance with the proposed algorithm, but partially makes mistakes in presenting the results	Conducts an experiment in accordance with the proposed algorithm, draws up and correctly interprets the results

Independent work - 20	0-11	12-15	16-17	18-20
Solution of the task (clinical case)	Not independent (rewritten work)	The problem is defined correctly, but the proposed explanation is not correct.	The correct solution of the problem is given and a brief interpretation is given.	The correct solution of the task is given, the analysis and interpretation of the results obtained are fully and systematically presented.
Working with information	Unable to find the necessary information, or find its individual fragments within the framework of the task	Can find the necessary information within the task	Can both interpret and systematize the necessary information within the framework of the task.	Can find and systematize the necessary information, as well as identify additional sources of information within the framework of the task.
Conducting a laboratory experiment	Does not participate in the laboratory experiment, but presents its result	Conducting an experiment with the help of laboratory assistants	Conducts the experiment independently and only draws up the results without interpreting the results	Conducts an experiment in accordance with the proposed algorithm independently, draws up and correctly interprets the results

Conduct Policy: (lateness, absence, behavior in the auditorium, late submission of work).
- Punctuality and completion of tasks.
- Mandatory attendance of classes.
- Attending class in a clean medical uniform.
- Eliminating conversations on a cell phone in the classroom.
- Active participation in the learning process.
- Doing homework on time.
- Academic detention at the time specified by the teacher.

For violations of the Conduct Policy, the total points for discipline might be reduced to1-10 points.

Academic Ethics Policy.
- Be tolerant, respect the opinions of others.
- Formulate objections in the correct form.
- Constructively support feedback in all classes.
- Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the following: the absence of references when using printed and electronic materials, quotes, thoughts and works of other authors or students.
- For violations of the Academic Ethics Policy, the total points for the discipline may be reduced to 1-10 points.

Guidelines for the lecture:

Key questions covered in lecture #1: *Introduction to biochemistry. Organization of the cell. Biomolecules. Transport of substances across membranes into extracellular fluid*

1.1. Biochemistry as a science: definition, scope, and significance in medicine.
1.2. Biochemical organization of the cell: organelles, compartments, and functional specialization.
1.3. Biological membrane structure and mechanisms of membrane transport.
1.4. Major biomolecules: classification, structure, and general biological roles.
1.5. Transport of substances across membranes into the extracellular fluid.

Recommended reading for the lecture #1:

1. Biochemistry. 6th ed. Satyanaryana U. 2021 pp. 521–594
2. Textbook of Biochemistry. 9th ed.Vasudevan D.M. 2019 pp.10-155
3. Lippincott's Iliustrated Reviews: Biochemistry. 7th ed. Ferrier D.R. 2017 pp. 411–432; pp. 433–446; pp. 447–464; pp. 465–480; pp. 481–504;
4. Textbook of Biochemistry. 4th ed. DM Vasudevan. 2016 pp. 30-120

Key questions covered in lecture #2: *Amyloidosis. Neurodegenerative dementias due to amyloids*

2.1. Chaperone and chaperonin systems: structure, functions, and role in protein folding.
2.2. Protein misfolding and genetic defects: pathogenesis of amyloidosis.
2.3. Neurodegenerative disorders associated with amyloidosis: Alzheimer's disease and prion diseases.

Recommended reading for the lecture #2:

1. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 25–35;

2. Textbook of Biochemistry. 4th ed. DM Vasudevan. 2016 pp. 410-460
3. Biochemistry. 6th ed. Satyanaryana U. 2021 pp. 1–164;

Key questions covered in lecture #3: *Structure, functions and disorders of Immunoglobulins. HIV and AIDS*

3.1. Structure, biological functions, and clinical disorders of immunoglobulins.
3.2. Principles of innate immunity: complement system including opsonization, MAC formation, chemotaxis, and inflammation.
3.3. Cytokines: classification, functions, and role in immune responses.
3.4. Diseases caused by impaired innate immunity: susceptibility to infections and immune-mediated disorders.
3.5. HIV infection and AIDS: virology, pathogenesis, immune system impact, and clinical features.

Recommended reading for the lecture #3:

1. Satyanaryana U.Biochemistry (5th education) 2017 pp. 697-701
2. Satyanarayana U.. Biochemistry (6th ed. 2021) pp. 521–594;
3. Murray R.K Harper's Illustrated Biochemistry 26th ed 2003 pp. 580-597.
4. DM Vasudevan. Textbook of Biochemistry. 4th ed. 2016 pp. 18-25;230;

Key questions covered in lecture #4 *General characteristics and classification of enzymes. Regulation of enzymatic activity*

4.1. Chemical nature of enzymes: prosthetic groups, cofactors (including vitamins), monomeric and oligomeric enzymes, and multienzyme complexes.
4.2. Mechanism of enzyme action: activation energy, catalytic effect, and reaction mechanisms (sequential and ping-pong).
4.3. Allosteric regulation of enzymes: conformational changes, feedback control, and classification of allosteric enzymes.
4.4. Activation of latent enzymes: covalent modifications, zymogen activation, phosphorylation, redox regulation, and association-dissociation mechanisms.
4.5. Neurohumoral regulation of enzyme synthesis and activity.

Recommended reading for the lecture #4:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp.53-67
2. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 47-58;
3. Satyanaryana U. Biochemistry (5th education) 2017 pp. 87- 119
5. Mukhamedova I. Biochemistry practical book 2010 pp. 81-96

Key questions covered in lecture #5: *Clinical enzymology*

5.1. Plasma enzymes: sources and mechanisms underlying abnormal plasma levels.
5.2. Isoenzymes: definition, plasma determination, and clinical significance.
5.3. Clinical characteristics and diagnostic significance of CPK, LDH, AST, ALT, ALP, and ACP.

Recommended reading for the lecture #5:

1. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 60–72; pp. 73–86; pp. 87–96;
2. Satyanaryana U. Biochemistry (6th education) 2021 pp. 85-112
3. Satyanaryana U. Biochemistry (5^{th} education) 2017 pp. 85-115

Key questions covered in lecture #6: *Vitamins in human nutrition. Biological role of dietary fibre.*

6.1. Dietary sources, supply patterns, and biological functions of vitamins.
6.2. Primary (dietary) and secondary vitamin deficiencies, hypovitaminosis, hypervitaminosis, and toxic effects.
6.3. Vitamin D: dietary and endogenous sources, metabolism, and mechanism of action.
6.4. Vitamin D deficiency diseases: rickets, osteomalacia; overdose and complications including PTH imbalance and renal osteodystrophy.
6.5. Biological and physiological roles of dietary fibre.

Recommended reading for the lecture #6:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp. 357-399
2. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 481- 497.
3. Satyanaryana U. Biochemistry (6th education) 2021 pp. 113-162
4. DM Vasudevan. Textbook of Biochemistry. 4th ed. 2016. pp. 271; 290;

Key questions covered in lecture #7: *Minerals in human nutrition: functions, sources, metabolism, and disorders. pH, water, and electrolyte balance.*

7.1. Physiological functions of essential minerals in the human body.
7.2. Major intracellular cations (Mg^{2+}, Ca^{2+}): distribution, biological roles, and mechanisms of homeostatic regulation.
7.3. Clinical aspects of hypo- and hypermagnesemia; hypo- and hypercalcemia.
7.4. Transition metal ions (Zn^{2+}, Se, Fe^{2+}): biological roles, homeostasis, deficiency disorders, and recommended intake.
7.5. Regulation of pH, water, and electrolyte balance in the human body.

Recommended reading for the lecture #7:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp. 357-399
2. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. pp. 6–14; pp. 546–563;
3. Satyanaryana U. Biochemistry (6th education) 2021 pp. 113-162
4. DM Vasudevan. Textbook of Biochemistry. 4th ed. 2016. pp. 271; 290;

Key questions covered in lecture #8: *Metabolism and hormonal control.*

8.1. Definition of metabolism and mechanisms of metabolic regulation.
8.2. Endocrine system: hormonal effects and local signaling (autocrine and paracrine communication).
8.3. Mechanisms of hormone synthesis and secretion regulation.
8.4. Chemical nature and classification of hormones (peptide, steroid, amine).

Recommended reading for the lecture #8:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp. 357-399
2. Champe P.C., Richard A. Harvey Lippincott's Illustrated reviews of Biochemistry 2004 pp. 319-330;
3. Satyanaryana U. Biochemistry (5th education) 2017 pp. 119-165.
4. Murray R.K Harper's Illustrated Biochemistry 26th ed 2003 pp. 481- 497

Key questions covered in lecture #9: *Mechanism of hormone's action. Pathological mechanism of endocrine diseases control*

9.1. Mechanisms of hormonal action via membrane-bound receptors and second messenger systems (G-protein, tyrosine kinase, cAMP, IP3/DAG).
9.2. Mechanisms of hormonal action via nuclear (intracellular) receptors (steroid and thyroid hormones).
9.3. Pathophysiological mechanisms underlying endocrine disorders (receptor defects, hormone synthesis abnormalities, resistance, autoimmune and genetic disorders).

Recommended reading for the lecture #9:

1. Satyanarayana U.. Biochemistry (6th ed. 2021) pp. 1–164;
2. Ferrier D.R.. Lippincott's Illustrated Reviews: Biochemistry (7th ed. 2017) pp. 1–52;
3. Rodwell V.W., Bender D.A., Kennelly K.M.. Harper's Illustrated Biochemistry (30th ed. 2015) pp. 25–35;
4. Mukhamedova I.P. Biochemistry practical book, pp. 102 – 123

Guidelines for the lessons (practical class) of the discipline

Key questions covered in lesson #1: *Amino acids and proteins: structural organization, classification. Nutritional and metabolic significance*

1.1. Role of amino acid and protein biochemistry in clinical diagnostics.
1.2. Amino acids: structure, chemical properties, and biologically active peptides (glutathione, renin-angiotensin system, bradykinin, oxytocin, ADH).
1.3. Proteins: structural organization, properties, and biological roles.

Recommended reading for the lesson #1:

1. Biochemistry. 6th ed. Satyanaryana U. 2021 pp.1-89
2. Textbook of Biochemistry. 9th ed.Vasudevan D.M. 2019 pp.1-155
3. Lippincott's Iliustrated Reviews: Biochemistry. 7th ed. Ferrier D.R. 2017 pp. 1-69
4. Textbook of Biochemistry. 4th ed. DM Vasudevan. 2016 pp. 1-120
5. Mukhamedova I.Biochemistry practical book 2010 pp. 22-40; 61-78

Key questions covered in lesson #2: *Clinical aspects of proteins. Protein energy malnutrition (PEM)*

2.1. Plasma proteins: types, biological functions, and clinical significance.
2.2. Biochemical techniques for protein analysis: chromatography, electrophoresis, dialysis, and clinical applications.
2.3. Serum protein electrophoresis: normal patterns and pathological alterations
2.4. Determination of serum total protein: principles of colorimetric methods.
2.5. Protein-energy malnutrition (PEM): types, biochemical alterations, and clinical significance.

Recommended reading for the lesson #2:

1. Satyanarayana U.. Biochemistry (6th ed. 2021) pp. 1–164;
2. Ferrier D.R.. Lippincott's Illustrated Reviews: Biochemistry (7th ed. 2017) pp. 1–52;
3. Rodwell V.W., Bender D.A., Kennelly K.M.. Harper's Illustrated Biochemistry (30th ed. 2015) pp. 668–688;

Key questions covered in lesson #3: *Characteristics of individual plasma proteins*

3.1. Albumin: biological roles, transport functions, and clinical consequences of hypoalbuminemia (pathogenesis of edema).
3.2. Haptoglobin and transferrin: biological roles and clinical significance (including disorders of iron metabolism).
3.3. α1-Antitrypsin: function, deficiency, and associated pulmonary and hepatic disorders.
3.4. α2-Macroglobulin: biological role and clinical significance.
3.5. α1-Fetoprotein (AFP): biological role and clinical significance as a tumor marker.

Recommended reading for the lesson #3:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp. 1-52;
2. Textbook of Biochemistry. 9th ed.Vasudevan D.M. 2019 pp.85-120
3. Satyanaryana U. Biochemistry (5th education) 2017 pp. 182-195.
4. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 458-470

Key questions covered in lesson #4: *Components of adaptive immune system*

4.1. Adaptive immune response: overview of T- and B-lymphocyte activation and immunoglobulin production.
4.2. Structure of immunoglobulins and their isotypes (IgG, IgA, IgM, IgE, IgD).
4.3. Mechanisms of antibody action: neutralization, agglutination, complement activation, and interaction with effector cells.
4.4. Immunochemical techniques: primary binding tests (RIA, ELISA) and secondary binding tests (agglutination).

Recommended reading for the lesson #4:

1.Satyanaryana U.Biochemistry (5th education) 2017 pp. 697-701
2. Murray R.K Harper's Illustrated Biochemistry 26th ed 2003 pp. 580-597.

4.DM Vasudevan. Textbook of Biochemistry. 4th ed. 2016 pp. 18-25; 230;

Key questions covered in lesson #5: *Extracellular matrix (ECM) functions in health and disease; protein targeting, sorting, and related disorders*

5.1. Elastin: structure, desmosine cross-links, and role in connective tissue function
5.2. Fibrillin: structure, biological role, and Marfan syndrome due to fibrillin defects
5.3. Collagen: types, structure, biosynthesis, and post-translational modifications
5.4. Diseases due to abnormal formation of collagen: osteogenesis imperfecta, Ehlers-Danlos syndrome
5.5. Biochemical markers of collagen degradation in bone: urinary Pyd and Dpd

Recommended reading for the lesson #5:

1. Biochemistry. 6th ed. Satyanaryana U. 2021 pp. 1–164;
2. Textbook of Biochemistry. 9th ed.Vasudevan D.M. 2019 pp.10-155
3. Lippincott's Iliustrated Reviews: Biochemistry. 7th ed. Ferrier D.R. 2017 pp. 35-69
4. Textbook of Biochemistry. 4th ed. DM Vasudevan. 2016 pp. 30-120

Key questions covered in lesson #6: *Hemoglobin and hemoglobinopathy*

6.1. Hemoglobin: structure, isotypes, globin gene families, and developmental regulation of synthesis.
6.2. Transport of gases by erythrocytes: oxygen and carbon dioxide carriage and physiological regulation.
6.3. Hemoglobin buffer system, hemolysis-related renal effects (myoglobinuria, hematuria), and heme-induced nephrotoxicity.
6.4. Structural hemoglobinopathies: sickle cell trait and disease, and molecular pathogenesis of RBC sickling.
6.5. Production hemoglobinopathies: α- and β-Thalassemia, types, and overview of porphyrias.
6.6. Functional hemoglobinopathies: methemoglobinemia and carboxyhemoglobin, toxicity, protective mechanisms, and treatment.

Recommended reading for the lesson #6:

1. Satyanarayana U.. Biochemistry (6th ed. 2021) pp. 1–164;
2. Ferrier D.R.. Lippincott's Illustrated Reviews: Biochemistry (7th ed. 2017) pp. 1–52;
3. Rodwell V.W., Bender D.A., Kennelly K.M.. Harper's Illustrated Biochemistry (30th ed. 2015) pp. 51–59;

Key questions covered in lesson #7:

Assessment # 1

Module by unit: Organization of the cell. Proteins.

I. MCQs
II. Check laboratory and practical works
III. PBL and clinical cases

Key questions covered in lesson #8: *Enzymes: Factors affecting enzyme activity.*

8.1. Specificity of enzyme action: substrate, stereochemical, and functional group specificity.
8.2. Factors affecting enzyme activity: enzyme and substrate concentrations (Michaelis-Menten kinetics), pH, temperature, cofactors, activators, and inhibitors.
8.3. Enzyme inhibition: competitive and non-competitive mechanisms and their effects on enzyme kinetics.

Recommended reading for the lesson #8:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp.53-67
2. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 47-58;
3. Satyanaryana U. Biochemistry (5th education) 2017 pp. 87- 119
5. Mukhamedova I. Biochemistry practical book 2010 pp. 81-96

Key questions covered in lesson #9: *Inhibitors and activators of enzymes in clinical use*

9.1. Enzyme inhibitors: mechanisms of action and effects on enzyme kinetics (Km, Vmax).
9.2. Enzyme activators: mechanisms of action and effects on enzyme kinetics.
9.3. Clinical applications of enzyme inhibitors and activators.

Recommended reading for the lesson #9:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp.53-67
2. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 47-58;
3. Satyanaryana U. Biochemistry (5th education) 2017 pp. 87- 119
5. Mukhamedova I. Biochemistry practical book 2010 pp. 81-96

Key questions covered in lesson #10:

Assessment # 2

Module by unit: Enzymes. Clinical enzymology

IV. MCQs
V. Check laboratory and practical works
VI. PBL and clinical cases

Key questions covered in lesson #11: *Fat-soluble vitamins*

11.1. Vitamin A: sources, supply pattern, biological functions, and clinical indicators of deficiency.
11.2. Vitamin A deficiency: ophthalmic and dermatologic manifestations; toxicity from overdose.
11.3. Vitamin E: dietary sources, metabolic functions, and clinical manifestations of deficiency.
11.4. Vitamin K: metabolism, transport, tissue distribution, biological role, and deficiency disorders.

Recommended reading for the lesson #11:

1. Ferrier D.R. Lippincott's Illustrated reviews: Biochemistry. (7th ed 2017) pp. 357-399
2. Harper's Biochemistry. 30ed. V.W. Rodwell, D.A. Bender, K.M.Kennely. 2015 pp. 481- 497.

3. Satyanaryana U. Biochemistry (6th education) 2021 pp. 113-162
4. DM Vasudevan. Textbook of Biochemistry. 4th ed. 2016. pp. 271; 290;

Key questions covered in lesson #12: *Water-soluble vitamins: hematopoietic vitamins*

12.1. Sources, absorption, transport, and tissue distribution of folic acid and vitamin B12.
12.2. Metabolic roles of folic acid and vitamin B12 in DNA synthesis and the methylation cycle.
12.3. Causes and clinical manifestations of folic acid and vitamin B12 deficiency.
12.4. Biochemical screening tests for hematopoietic vitamin deficiencies.

Recommended reading for the lesson #12:

1. Satyanarayana U.. Biochemistry (6th ed. 2021) pp. 1–164;
2. Ferrier D.R.. Lippincott's Illustrated Reviews: Biochemistry (7th ed. 2017) pp. 377–398;
3. Rodwell V.W., Bender D.A., Kennelly K.M.. Harper's Illustrated Biochemistry (30th ed. 2015) pp. 546–563; pp. 537–545;

Key questions covered in lesson #13: *Water- soluble vitamins: energy-releasing vitamins.*

13.1. Energy-releasing B-complex vitamins: sources, structure, metabolic functions, and deficiency disorders.
13.2. Non-B-complex water-soluble vitamins: sources, structure, metabolic functions, and deficiency disorders.
13.3. Sources and functions of B4, B5, B6, and vitamin-like substances.
13.4. Deficiency diseases of B4, B5, B6, and vitamin-like substances.

Recommended reading for the lesson #13:

1. Satyanarayana U.. Biochemistry (6th ed. 2021) pp. 1–164;
2. Ferrier D.R.. Lippincott's Illustrated Reviews: Biochemistry (7th ed. 2017) pp. 377–398;
3. Rodwell V.W., Bender D.A., Kennelly K.M.. Harper's Illustrated Biochemistry (30th ed. 2015) pp. 546–563; pp. 537–545;

Key questions covered in lesson #14:

Assessment # 2

Module by unit: Vitamins and minerals in human nutrition. Metabolism and hormonal control of cell organization.

VII. MCQs
VIII. Check laboratory and practical works
IX. PBL and clinical cases

Guidelines for the lessons (laboratory work) of the discipline

Laboratory work 1*: Introduction to biochemical laboratory. Quantitative reactions for amino acids and proteins. Precipitation & denaturation of proteins*

1.1. Precipitation of proteins by salting out
1.2. Denaturation of proteins
1.3. Neumann's test for phosphoproteins
1.4. Analysis of glycoproteins.

Recommended reading for the laboratory work #1

1. Printed laboratory material (Laboratory report)

Laboratory work 2: *Methods of laboratory manual techniques: colorimetry, spectrometry. Determination of plasma proteins*

Recommended reading for the laboratory work #2

1. Printed laboratory material (Laboratory report)

Laboratory work 3: *Investigation of oxidoreductase and hydrolase action & factors affecting enzyme's activities*

Recommended reading for the laboratory work #3

1. Printed laboratory material (Laboratory report)

Laboratory work 4: *Methods of laboratory manual technique: Titration (direct; reverse): Determination of vitamin C in food*

Recommended reading for the laboratory work #4

1. Printed laboratory material (Laboratory report)

Methodological instructions for the implementation of independent work on the discipline

1. Experimental work is carried out in the group according to the instructions given in the laboratory work report (sample collection, analytic phase, post-analytic phase)

Independent work includes the following types of work:

- work with lecture material, providing for the study of lecture notes and educational literature;
- search and review of literature and electronic sources of information on an individually given course problem, writing a report on a given problem;
- doing homework for class;
– preparation for laboratory work, practical and seminar classes;
– independent laboratory work on a given topic;
– preparation for control work;
- preparation for the test.