

**INTERNATIONAL HIGHER SCHOOL OF MEDICINE**  
**Department of Fundamental disciplines**

**SYLLABUS**

**Laboratory analytics & diagnostics**

2025-2026 academic year

for students of medical faculty

2 course, 3 semesters, 7 groups


1 credit (30 h, including auditorial -18 h, independent work (scientific investigation) – 12 h)

**Lecturer:** **Keneshova Kanykei** (5, 8, 10, 11, 16, 17 and 23 groups)  
(0500)023-326 (Whatsapp)  
Email: kanykeisadyrbekovna@gmail.com

**Venue:** Zoom-meeting  
<https://us04web.zoom.us/j/6900196557?pwd=JHuEgLUY13GUTFILCfxKYicHupTLXL.1>

**Practical classes:** **Keneshova Kanykei** (5, 8, 10, 11, 16, 17 and 23 groups)  
(0500)023-326 (Whatsapp)  
Email: kanykeisadyrbekovna@gmail.com

**Venue:** Educational and Morphological Center:  
Campus 2 Classroom N304  
Lev Tolstoy street 114/1

The Syllabus is considered  
at the meeting of Fundamental Disciplines Department  
Protocol №1 dated 30.08.2025  
Head of the department  Satarkulova A.M.

**Course Objective** of the educational discipline Laboratory analytics and diagnostics is to master the fundamental basis of the methodology of clinical laboratory practice, as well as methods of extra-laboratory research, the formation of skills and abilities to work with biochemical equipment, conducting biochemical experiments and analyzing clinical and biochemical indicators to make a preliminary diagnosis on their basis.

*After study of the discipline the student must:*

**Knowledge:** Functional bases of normal and abnormal results of the biochemical testing; mechanisms of pathological deviations of biochemical research results; principles and methodology of work with basic biochemical laboratory equipment and safety rules when working with it; basic methods of descriptive statistical analysis and methodology of the Excel statistical program use; basic information and communication resources in the field of laboratory science

**Skill:**

- to evaluate the diagnostic potential of biochemical tests and to interpret laboratory test results;
- to select appropriate methods and equipment for performing biochemical testing;
- to carry out quality control procedures for volumetric laboratory glassware;
- to use information and communication resources in the field of laboratory practice.

**Possess skills:**

- work with biochemical laboratory equipment and instrumental techniques;
- making a preliminary diagnosis of considered diseases on the basis of the results of biochemical research;
- descriptive statistical analysis of the obtained data and their interpretation;
- searching and selecting information using qualitative resources;
- presented final results in the form of protocols, scientific text and presentation.

**Attitude:** Interpret the results of laboratory tests; select methods and equipment for biochemical testing

**Pre-requisites:** Normal Physiology, medical chemistry, biochemistry, anatomy, histology, pathology

**Post-requisites:** Internal medicine, family and polyclinical medicine, pediatrics, emergency medicine, public health

#### THEMATIC PLAN OF LECTURES

№	Theme of lecture	Hours	Date
1	Biochemical clinical testing, intergrating POCT,artificial intelligence and pH measurement and ABG analysis	2	01.09 – 06.09

#### THEMATIC PLAN OF PRACTICAL CLASSES (SEMINAR)

№	Theme of practical class	Hours	Date
1	The fundamentals of statistical analysis	2	01.09 – 06.09
2	Diagnostic and prognostic biomarkers for acute coronary syndrome (ACS)	2	04.09 – 20.09
3	Diagnostic testing of iron deficiency anemias	2	05.09 – 04.10
4	CSF analysis and interpretation	2	10.09 – 11.10
5	Group presentation of independent scientific investigation (article)	2	19.09 – 25.10

#### THEMATIC PLAN OF LABORATORY CLASSES

№	Theme of laboratory work	Hours	Date
1	Calibration of Graduated Volumetric Glassware and Statistical Analysis of Data Set.	2	03.09 – 13.09
2	Cardiac biomarkers panel determination	2	05.09 – 27.09
3	CSF testing	2	10.09 – 18.10

#### THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS (Scientific investigation)

№	Theme of independent work	Hours	Date
1	Work with text material presented in Study Guides (lessons 1,2, 4-7)	4	01.09 – 27.09
2	Work with the test material in the section: Self-assessment questions & clinical cases (Study Guide)	4	27.09 – 22.10
3	Design of laboratory protocols and answers in the section of Pre-Lab & Post- Lab Quiz	4	30.09 – 25.10

**Recommended reading for the discipline:****Basic:**

1. Quantitative Methods for Health Research. 2nd ed. N.Bruce, D.Pope, D.Stanistreet. 2018
2. Mukhamedova I.P. Biochemistry practical book. –Bishkek, 2010.
3. Satyanarayana U., Chakrapani U. Biochemistry 5<sup>th</sup> ed. 2017

**Additional:**

1. William Marshal et al Clinical Biochemistry, 2017. - 605 p.
2. Allan Gavy, Robert Cowa, et al. Clinical Biochemistry, 2015
3. Dr.A.C.Deb Fundamentals of Biochemistry, 2004.-848p.

**4. 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

final score - 40 points

Maximum score: 100 = (40+ 20+ 40)

**Grading system for student's achievements****1) Current performance and milestone control in the unit:**

Criteria/ Point	Intervals			
	0 – 23	24 – 30	31 – 35	36 – 40
	Unsatisfactory	Satisfactory	Good	Excellent
<b>Systematicity and completeness of knowledge in relation to the objects being studied</b>	Has partial and scattered knowledge that is logically unrelated to each other.	Possesses the minimum set of knowledge necessary for a systematic approach to the object being studied.	Has a set of knowledge sufficient for a systematic approach to the object being studied.	Has complete knowledge and a systematic view of the object being studied.
<b>Work with information</b>	Unable to find the necessary information, or can only locate separate fragments of it within the framework of the assigned task.	Can find the necessary information within the framework of the assigned task.	Can also interpret and systematize the necessary information within the framework of the assigned task.	Can find and systematize the necessary information, as well as identify additional sources of information within the framework of the assigned task.
<b>Scientific understanding of the phenomenon, process, object being studied</b>	Cannot draw scientifically correct conclusions from available information.	Able to analyze some of the available information.	Able to carry out systematic and scientifically correct analysis of the information provided	Involves new task-relevant data into analysis and offers new perspectives on the task at hand
<b>Mastering standard solution algorithms</b>	Able to solve only fragments of the assigned task in accordance with the given algorithm.	Able to solve the assigned task in accordance with the given algorithm.	Understands the basics of the proposed algorithm and solves the assigned task accordingly.	Understands the basics of the proposed algorithm and proposes new solutions within the framework of the assigned task.
<b>Mastering the technique of laboratory experiment</b>	Did not master the proposed algorithm for a laboratory experiment and its design.	Conducts 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, formats and correctly interprets the results obtained.

## 2) Results of independent work

Criteria/ Point	Intervals			
	0 – 11	12 – 14	15 – 17	18 – 20
	Unsatisfactory	Satisfactory	Good	Excellent
<b>Working with information</b>	Unable to find the necessary information, or find its individual fragments within the framework of the assigned task.	Can find the necessary information within the given task.	Can interpret and systematize the necessary information within the framework of the assigned task.	Can find and systematize the necessary information, as well as identify additional sources of information within the framework of the task.
<b>Conducting a laboratory experiment and preparing protocols</b>	Does not participate in conducting the laboratory experiment, but presents its result.	Conducts the experiment with the assistance of laboratory staff and submits the protocol.	Conducts the experiment independently and only records the results without interpreting them.	Conducts the experiment independently in accordance with the proposed algorithm, prepares and correctly interprets the obtained results.
<b>Presentation of research results in the form of a scientific text and presentation</b>	Does not participate in the preparation of the scientific text.	Partially participates in the preparation of the experimental results.	Actively participates in preparing the material for the scientific text, but does not take part in the final stage of preparing the scientific text.	Actively participates in preparing the material for the scientific text, as well as in the final stage of its preparation and its presentation.

### 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 to 1-10 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: Clinical laboratory and Point-of- Care testing (POCT)

1. Clinical laboratory and biochemical testing (types, scope, organization)
2. Biochemical tests in clinical medicine (phases, errors, factors that can affect biochemical test result)
3. Point-of-Care Testing (POCT)
4. Artificial intelligence in laboratory medicine, applications in healthcare (diagnostics, automated data analysis and pattern recognition)
5. Clinical relevance of pH measurement
6. Arterial blood Gas analysis: principles, interpretations of ABG results, clinical case studies in ABG (diabetic ketoacidosis)

Recommended reading for the lesson

1. Quantitative Methods for Health Research. 2nd ed. N.Bruce, D.Pope, D.Stanistreet. 2018

### **Guidelines for the lessons (practical class) of the discipline**

#### **Key questions covered in lesson 1:** The fundamentals of statistical analysis (on Excel platform)

1. Quality Assurance and Quality Control of laboratory reports (accuracy / or bias, precision, sensitive, specificity; reference data, range)
2. Measures of frequency
3. Measures of central tendency (mean, median, mode);
4. Measures of dispersion or variation (range; standard deviation; variance; confidence interval)
5. Indicators of laboratory test reliability (accuracy, precision, bias, sensitivity, specificity)

#### **Recommended reading for the lesson 1**

1. Quantitative Methods for Health Research. 2nd ed. N.Bruce, D.Pope, D.Stanistreet. 2018
2. Excel program (version 10 and higher)

#### **Key questions covered in lesson 2:** Diagnostic and prognostic biomarkers for acute coronary syndrome (ACS)

1. ACS: definition, causes, classification according to the changes in ECG
2. Biochemical pathological processes in myocardium due to hypoxia
3. Current markers of cardiac necrosis: CK-MB, CK-MB isoforms; Mb; cTnI, cTnT, hsTn
4. Markers of inflammation: MPO, CPR, PGF, MMP
5. Markers of cardiac ischemia: PL-D, FABP, IMA

#### **Recommended reading for the lesson 3**

1. Quantitative Methods for Health Research. 2nd ed. N.Bruce, D.Pope, D.Stanistreet. 2018
2. Satyanarayana U., Chakrapani U. Biochemistry 5th ed. 2017
3. Internet resources: Scientific articles/ key words: biomarkers, acute coronary syndrome

#### **Key questions covered in lesson 3:** Diagnostics of iron-deficiency anemias

1. Hematopoiesis (overview)
2. Anemias: deficiency, causes, classification
3. Iron deficiency anemia: stages, diagnostic criteria
4. Interpretation of clinical protocol

#### **Recommended reading for the lesson 2**

1. Quantitative Methods for Health Research. 2nd ed. N.Bruce, D.Pope, D.Stanistreet. 2018
2. Internet resources: Scientific articles/ key words: dynamic tests, GIT, pancreas test, iron status assay; breath test

#### **Key questions covered in lesson 4:** CSF examination

1. CSF formation
2. Macroscopic, biochemical & microscopic examination of CSF
3. Interpretation of CSF examination data (OSCE)

#### **Recommended reading for the lesson 4**

1. Quantitative Methods for Health Research. 2nd ed. N.Bruce, D.Pope, D.Stanistreet. 2018
2. Mukhamedova I.P. Biochemistry practical book. –Bishkek, 2010.
3. Internet resources: Scientific articles/ key words: liver function test, interpretation, bilirubin metabolism, jaundice

### **Guidelines for the laboratory works of the discipline**

#### **Laboratory work 1:** Calibration of Graduated Volumetric Glassware & Statistical Analysis of Data Set.

1. Calibration methods (types, characteristics); calibration curve
2. Pre-Lab. & Post-Lab Quiz
3. Statistical analysis of data set
4. Laboratory report

#### **Recommended reading for the laboratory work 1**

1. Printed laboratory material (Laboratory report)
2. Internet resources: Scientific articles/ key words: calibration, analytical chemistry, colorimetry, calibration curve (plot)

#### **Laboratory work 2:** Detection of some cardiac biomarkers

1. Determination of blood AST
2. Determination of serum total creatine phosphokinase (CPK)
3. Determination of cardiac troponin (cTn) by immunoassay (POCT)
4. Laboratory report

#### **Recommended reading for the laboratory work 2**

1. Printed laboratory material (Laboratory report)

#### **Laboratory work 3:** Macroscopic& Biochemical examination of CSF

1. Macroscopic examination of CSF

2. Analysis of the CSF glucose
3. Analysis of the CSF albumin & globulin
4. Analysis of CSF electrolytes
5. Laboratory report

Recommended reading for the laboratory work 3

1. Printed laboratory material (Laboratory report)

**Methodological instructions for the implementation of independent work:**

1. Work with the textual material presented in the Study Guides (sessions 1, 2, 4–7).
2. Work with the assessment material presented in the section: Self-assessment questions & clinical cases (Study Guide).
3. Preparation of laboratory work protocols and answers to the questions in the sections Pre-Lab & Post-Lab Quiz.