

**MEDICAL UNIVERSITY- PLOVDIV  
FACULTY OF MEDICINE  
DEPARTMENT OF CLINICAL LABORATORY**

**ACADEMIC STANDARD  
FOR  
THE DISCIPLINE “CLINICAL CHEMISTRY”**

**1. Purpose of the education**

The main purpose of the course in “Clinical Chemistry” is to organize and implement optimal training, providing Pharmacy students with the necessary knowledge for complete and effective work in clinical laboratories and clinical pharmacy laboratories.

The purpose is consistent with:

- The mission and concept of the Medical University – Plovdiv
- The volume and credit rating of the discipline (ECTS system), as outlined in the curriculum
- The qualification characteristic of the specialty
- Educational level: Master degree in pharmacy

**2. Educational content of the course**

The topics and academic hours of the lectures and exercises are listed on the website of the university.

The content is arranged chronologically so that each subsequent lecture and related practical classes are based on the learned matter and concepts. The unnecessary overlap or the existence of "white spots" between "curriculum-related" disciplines is avoided.

**3. Prerequisites**

The student must have a basic knowledge of biology, chemistry and educational programs in high schools in order to begin and successfully complete training in a clinical chemistry.

**4. Academic resources**

The academic staff of the Department of Clinical Laboratory includes 1 Professor and 7 Assistant Professors. The lectures are delivered by a habilitated lecturer (Assistant Professor or Professor) with a scientific degree (Doctor or Doctor of medical sciences) in the corresponding doctoral program. Up to 30% of lectures are awarded to Assistant Professors with PhD degree in the relevant doctoral program. Practical classes are held by Assistant Professors with a Master's degree in medicine, and are appointed after a selection exam.

## 5. Material resources

The Department of Clinical Laboratory at the Medical University - Plovdiv has 3 (three) administrative offices, 4 (four) classrooms and 2 (two) training laboratories. The administrative offices are:

- One for Head of Department with an area of 12.7 m<sup>2</sup>
- One for Assistant Professors with an area of 16 m<sup>2</sup> and 4 workplaces
- One for PhD students with an area of 15 m<sup>2</sup> and 3 workplaces

The classrooms and training laboratories have a total area of 178.5 m<sup>2</sup>:

- Classroom №1 – 31 m<sup>2</sup> with 12 workplaces for students
- Classroom №2 – 30 m<sup>2</sup> with 12 workplaces for students
- Classroom №3 – 30 m<sup>2</sup> with 12 workplaces for students
- Classroom №4 – 30 m<sup>2</sup> with 20 workplaces for students
- Classroom №5 – 30 m<sup>2</sup> with 24 workplaces for students
- Training laboratory 1 – 30 m<sup>2</sup> with 8 workplaces for students
- Training laboratory 2 – 30 m<sup>2</sup> with 8 workplaces for students

The Department of Clinical Laboratory has 4 “Leica” light microscopes for training purposes of students, PhD students and postgraduate students. In addition to general equipment (laboratory scales, refrigerators, thermostats, centrifuges, etc.). The Department uses the modern equipment of the Central Clinical Laboratory of the University Hospital “St. George”:

- Atomic Absorption Spectrometer (Thermo Scientific, UK)
- Immunological Analyzers Access 2 (Beckman Coulter, USA) and Architect plus i2000SR (Abbott, USA)
- Clinical-chemical analyzers "Olympus AU480" (Beckman Coulter, USA) and "Konelab Prime 60i" (Thermo Scientific, USA)
- Sysmex CS-2500 coagulometer (Beckman Coulter, USA)
- Advia 2120 Hematology System (Siemens, Germany)

## 6. Lectures

The lectures are delivered as multimedia presentations and provided to the students in advance. The extent and format of the lectures are chosen by the lecturer.

## 7. Practical classes

Practical classes are held separately for each group. Methodical instructions, guides and tests are provided for the exercises. Independent or team tasks are assigned. Ongoing control is held of:

- Student preparation
- The results (acquired knowledge and skills) of the specific exercise.

As a methodical form, preference is given to teamwork, team discussions. Students may be assigned tasks to prepare and argument their thesis (presentation) on a topic, previously defined by the lecturer. The same topic is further discussed among the students in the group.

Practical exercises are illustrated with printouts from analyzers, documented data for quality control of laboratory results.

## 8. Information resources. Basic literature. Websites

The lecturer is required to develop and provide in electronic or in paper form his lectures, training tests or other teaching materials. The main recommended literature for the discipline is listed, with priority of the available resources, including internet resources.

### *Bibliography*

1. Guide to practical trainings in clinical chemistry for pharmacy students. ed. by K. Tzatchev. Plovdiv, Lax book, 2014.
2. Clinical laboratory interpretation of results. ed. by T. Deneva, Plovdiv, 2021
3. Devlin, T. M. (ed.). Textbook of Biochemistry with Clinical Correlation, Fifth Edition, New York, Wiley-Liss, 2002.
4. Marshall, William J. et al. Clinical chemistry / William J. Marshall, Andrew Day, Marta Lapsley. - 8th ed.- Edinburgh : Elsevier, 2017.
5. Clinical chemistry: Principles, techniques, and correlations / Ed. Michael L. Bishop, Edward P. Fody, Larry E. Schoeff. - 7th ed.- Philadelphia: Wolters Kluwer / Lippincott Williams & Wilkins, 2013

## 9. Control assignments

Students should be engaged dynamically and intensively throughout the semester. This approach is based on the understanding, that the way of acquiring knowledge and skills is an important factor for the depth, durability and applicability. Ongoing control tests the level of learning of theoretical knowledge and practical skills, and is a mandatory element of the learning activity. The purpose of the current control is to motivate students learn the material in the discipline more permanently and qualitatively. Continuous control of students' knowledge is conducted by oral examination or tests, at least twice a semester. Students are provided with timely information and comment on the results of the control (at the next exercise) for further assistance of their preparation. Up to 3 (three) days after the results are announced, the student has the right to get acquainted with his/ her work.

The results of these tests are a component in the final semester grade.

- **Poor (2)** - the student demonstrates a scarce knowledge that cannot serve as a base of subsequent levels of learning - pre-clinical and clinical.

- **Satisfactory (3)** - the student reproduces knowledge in a "ready-made scheme", missing the main points of the topic being developed; the reference ranges are partially learned, encounters serious difficulties in presenting: the principles of clinical laboratory methods, the results of clinical laboratory studies, has gaps in the practical skills to perform basic laboratory activities, the terminology is not well and properly understood, the presentation is characterized by simple language.

- **Good (4)** - the student develops the topic descriptively, reproductively, using standard situations, shows limited independence in the presentation of clinical laboratory methods, performs basic clinical laboratory activities relatively well, knows the reference limits of clinical laboratory parameters in the presentation, although good linguistic culture, inaccuracies in the concepts used are shown.

- **Very good (5)** - the student develops the topic by himself productively, unconventional, uses the knowledge learned in the training course and textbooks, knows innovative methods of analysis in the clinical laboratory and correlation between different laboratory parameters, knows very well the diagnostic reliability of clinical laboratory results, is able to solve clinical laboratory diagnostic

tasks with minimal gaps, adequately uses clinical laboratory terms, has a good linguistic culture.

- **Excellent (6)** - the student independently, logically, with the presence of a creative element brings out the topic, understands the subject in a meaningful way, is acquainted with innovative methods of analysis in the clinical laboratory, knows in deep the diagnostic reliability of the results, knows the information that results brings, the reference limits have been fully mastered, there is a willingness to use the acquired theoretical knowledge and practical skills; accuracy and rich linguistic culture of the exhibition.

When starting classes, students should be familiar with the standards of assessment, the procedures for conducting ongoing supervision, and the opportunities to receive feedback on their progress during the semester.

## 10. Self-preparation and extracurricular work of the student

The self-learning of the student is guided by the lecturer (assistant) who guides the student both in the references and in the methods of their use. They also provide training tests, incl. on-line, for independent work and student exercises.

## 11. Collaboration between students and teaching staff

This collaboration is expressed in:

- Responsibility of the teacher to the student and his/her ongoing training, the difficulties in learning the material and opportunities of further achievements through individual learning program.
- Usage of consultation hours.
- Involving the students in teams for scientific tasks, researches, projects, etc.

## 12. Exams

Current assessments planned in the curriculum of the discipline are given for:

1. Ongoing student's results during practical classes, coursework and individual assignments, participation in research projects with lecturer, etc.

2. At least two (one in the middle and one at the end of the semester) control writings or tests.

## 13. Evaluation standards

The success of the course in the discipline "Clinical Chemistry" in the syllabus is assessed as the value of the grades, divided into two main elements:

- **First element** - includes the assessment of the student's academic activity throughout the semester (20%). It includes assessments of current control (written tests, tasks or presentation on a specific theme at least twice during the semester. Tests and tasks are prepared by the individual assistants for the various topics. The final semester grade is formed on the basis of all current tests and tasks.
- **Second element** - includes the exam grade (80%). Regulation of the examination is organized so as to minimize the possibility of manipulating its results.

Clear assessment standards are being developed for the discipline. The levels of reproduction and use of knowledge by students are defined as information - reproductive, technological - productive, problematic

- productive, innovative - creative.

#### **14. Final grade formation**

The final grade determines the extent to which the student has achieved the goal of study set at the beginning of the academic standard. It is multicomponent and includes an evaluation of:

- Current control
- Final exam - The theoretical exam is in a written form on two questions from the questionnaire of Clinical Chemistry, individually selected by each student. The time for completing the written exam is two academic hours. Oral examination is held at the discretion of the examiners.

For each component involved in the final evaluation coefficient of significance (0 to 1) is determined and the total sum of the coefficients should always be 1. The final degree mark is obtained as sum of the components marks multiplied by the coefficients of significance.

$$\text{Final grade (Q)} = 0.20 \times Q_1 + 0.80 \times Q_2$$

**Q<sub>1</sub> - current control grade**

**Q<sub>2</sub> - final exam grade**

**If the grade from the final exam is poor 2, the final grade is necessarily poor 2**

#### **15. Documentation, storage of results and control of the assessment procedure**

• Assessed students have the right and obligation to be informed of the regulations, procedures and results of assessment, to make claims and complaints in the event of non-compliance with these rules.

• The student's right within the meaning of the preceding paragraph is valid in the case of identified technical defects or errors (for example in calculating or drawing up the grades), as well as on serious reasons for discrepancy between the actual knowledge, skills and competences shown and the final grade for them.

Adjustments to the grades in the preceding paragraph are allowed in the student book, exam protocol or in the general ledger account only by the chief of the discipline.

The exam materials are stored and the students are given the opportunity to get acquainted with them and the grounds for assessment according to the procedure and procedure announced in advance. The period during which students have access to the examination materials and results is no longer than three (3) working days after the exam date.

The characteristic of the discipline is provided to the student at the beginning of the course. This is in accordance with the law on higher education art. 56, paragraph 1: "Teachers are obliged to develop and publicize, in an appropriate manner and description, the lecture course they provide, including the titles and sequences of the topics of the course content, reference literature, the method of forming the assessment and the form of assessment of knowledge and skills."

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