FACULTY OF PHARMACY

STUDY PROGRAM 0916.1 PHARMACY

DEPARTMENT OF PHARMACEUTICAL AND TOXICOLOGICAL CHEMISTRY

APPROVED
at the meeting of the Commission for Quality Assurance and Evaluation of the Curriculum, Faculty of Pharmacy
Minutes No. 2 of 21.12.2017
Chairman PhD. associate professor
UNCU Livia

APPROVED
at the Council meeting of the Faculty of Pharmacy
Minutes No. 2 of 22.12.2017
Dean of Faculty PhD. associate professor
CIOBANU Nicolae

APPROVED
at the meeting of the chair of Pharmaceutical and Toxicological Chemistry.
Minutes No. 3 of 03.11.2017
Head of chair PhD. professor
VALICA Vladimir

SYLLABUS

DISCIPLINE **MODERN INSTRUMENTAL ANALYSIS**

Integrated studies

Type of course: **Optional**

Chisinau, 2017

I. INTRODUCTION

- **General presentation of the discipline: place and role of the discipline in the formation of the specific competences of the professional / specialty training program**

The ***Modern Instrumental Analysis*** course is a necessary discipline for students because it allows a deeper integration of the knowledge gained in previous courses and provides students with the opportunity to integrate the previously accumulated knowledge of physics, inorganic chemistry, analytical chemistry. It base the practical skills required in specialized disciplines like pharmaceutical chemistry and drug control.
This interdisciplinary course include full range of intellectual discipline, from conceptual understanding to the practical application of knowledge. It is designed and is recommended for Pharmacy specialty.

The ***Modern Instrumental Analysis*** course aims to help future pharmacists know the contemporary methods of analysis, used for standardization and control of drugs, and to develop the practical skills needed to ensure the quality of medicines.

- **Mission of the curriculum (aim) in professional training**

To provide students with knowledge of the principles of instrumental analysis used in practice in drug analysis and control.

- **Language (s) of the course:** romanian, english.
- **Beneficiaries:** students of the III-th year, faculty Pharmacy, specialtyPHARMACY.

II. MANAGEMENT OF THE DISCIPLINE

Code of discipline		**S.06.A.066**	
Name of the discipline		**Modern instrumental analysis**	
Person(s) in charge of the discipline		PhD in Pharmaceutical Sciences, professor **Vladimir Valica**	
Year	**III**	Semester	**6**
Total number of hours, including:			**60**
Lectures	**17**	Practical/laboratory hours	
Seminars	**34**	Self-training	**9**
Form of assessment	**C**	Number of credits	**2**

III. TRAINING AIMS WITHIN THE DISCIPLINE

At the end of the discipline study the student will be able to:

- ***at the level of knowledge and understanding:***
  - subject matter and objectives of the discipline;
  - the basic notions and principles encountered in instrumental analysis methods;
  - the particularities of analyzing and controlling the substance under consideration, depending on its nature and the proposed tasks;
  - the specificity of the physicochemical methods, including when they can not be applied in the pharmaceutical;
  - methods of analysis applied in laboratories for quality control and certification of medicinal products.
- ***at the application level:***
  - theoretical knowledge in the practice of professional activity;
  - practical skills in drug analysis and control;
  - optimal methods of analyzing drugs, according to their specific peculiarities;
  - responsibility and persistence in pharmaceutical activity.
- ***at the integration level:***
  - basic notions in scientific research;
  - basic concepts in statistics;
  - views in support of new ideas;
  - ability to use contemporary methods in the field of pharmaceutical research;
  - validation principles.

IV. PROVISIONAL TERMS AND CONDITIONS

It is a multidisciplinary science combining the knowledge of physics, inorganic chemistry, analytical chemistry and physics previously accumulated, and the foundation of other specialized disciplines such as pharmaceutical chemistry, drug control, pharmaceutical technology, pharmacology, pharmacognosis.

V. THEMES AND ESTIMATE ALLOCATION OF HOURS

Lectures, practical hours/ laboratory hours/seminars and self-training

No. d/o	THEME	Number of hours		
		Lectures	Seminars	Self-training
1.	Instrumental analysis. General considerations. Classification of instrumental analysis methods. Characteristics of instruments.	2	-	-
2.	Separation methods Classification of chromatographic methods.	2	-	-

No. d/o	THEME	Number of hours		
		Lectures	Seminars	Self-training
	Chromatography nomenclature. Adsorption Chromatography and Chromatography.			
3.	Adsorption chromatography. The working technique. Phase composition. Practical application.	-	2	-
4.	Gas Chromatography and High Performance Liquid Chromatography. General. Gear. Analytical applications. *Control assessments.*	2	2	2
5.	Spectrophotometry in UV and visible. Fluorescence Spectrometry. Equipment. Qualitative and quantitative analysis. Applications. IR spectrophotometry. Interpretation of IR spectra. Practical application.	2	3	2
6.	*Control assessments.*	-	2	-
7.	Nuclear Magnetic Resonance Spectrometry and Electronic Resonance Resonance. Atomic absorption spectrometry. Emission spectrometry.	2	2	-
8.	Non-Spectral Methods: Mass Spectrometry: Generalities. Gear. Detectors Analytical applications. Mass Spectrometry. Principle. Interpretation of mass spectra.	-	2	2
9.	Non-spectral methods. Refractometers. Optical Rotating Dispersion. Circular dichroism.	2	-	-
10.	Electrochemical methods. Potentiometers. Amperometric. Conductometry. Polarography.	2	2	-
11.	Roentgenographic methods. Thermal analysis methods.	3	-	3
12.	***Colloquium*.**	-	2	-
Total		**17**	**17**	**9**

VI. REFERENCE OBJECTIVES OF CONTENT UNITS

Objectives	Content units
Theme (chapter) 1. Instrumental analysis. General considerations.	
• Define the basic concepts of discipline; • be familiar with the classification of instrumental methods used in pharmaceutical analysis; • demonstrate abilities to analyze and systematize the theoretical knowledge; • apply the criteria for differentiating the methods used in drug control; • integrate the knowledge about	Fundamental concepts of drug analysis by instrumental methods. Methods of research and interpretation of experimental results. Laboratory safety technique. Practical applications of the discipline. Examples.

Objectives	Content units
instrumental analysis of drugs into pharmaceutical activity.	
Theme (chapter) 2. Methods of separation. Chromatographic methods.	
• Be familiar with the basic classifications of chromatographic methods; • define chromatographic concepts; • demonstrate skills to analyze errors in experimental measurements; • apply the knowledge gained for critical analysis of scientific publications; • integrate knowledge about separation methods in pharmaceutical practice.	Basic principles of chromatographic analysis. Particularities of selecting the method depending on the nature of the substance under consideration and the purpose of the research. The main elements of the chromatogram. Interpretation of the chromatogram and formulation of the results of the research.
Theme (chapter) 3. Spectrophotometric methods of analysis.	
• To define the concepts of spectral methods; • demonstrate solving skills for solvent analysis for spectrophotometric methods; • avoid possible errors in experimental measurements; • apply the knowledge gained for critical analysis of scientific publications; • integrate knowledge about spectrophotometric methods into pharmaceutical practice.	Basic principles of spectrophotometric analysis. The main elements of the UV-VIS spectrum. Interpretation of IR spectrum. The advantages and disadvantages of the spectrophotometric method.
Theme (chapter) 4. Non-spectral methods.	
• Define the concepts of non-spectral methods; • demonstrate skills for selecting methods; • avoid possible errors in experimental measurements; • apply the knowledge gained for critical analysis of scientific publications; • integrate acquired knowledge about non-spectral methods into pharmaceutical practice.	Fundamental concepts of drug analysis by non-spectral methods. Particularities of selecting the method depending on the nature of the substance under consideration and the purpose of the research.

VII. PROFESSIONAL (SPECIFIC (SC)) AND TRANSVERSAL (TC) COMPETENCES AND STUDY OUTCOMES

✓ Professional (specific) (SC) competences

- PC1. Identification, knowledge and appropriate use of instrumental methods of study in pharmaceutical analysis.
- PC 2. Good knowledge, understanding and operation of the theoretical knowledge and basic practical methods of instrumental analysis. Solving case studies, especially interpreting experimental results.
- PC 3. Professional possession of the principles of instrumental analysis in drug control.
- PC 4. Applying the theoretical and practical knowledge in solving the complex situational problems of instrumental analysis in the pharmaceutical activity.

✓ Transversal competences (TC)

- TC1. Apply rigorous and efficient work rules in the lab and observe safety and security techniques in pharmaceutical analysis prices.
- TC2. Ensure effective deployment and effective engagement in group activities. Identifying training needs according to the evolution of science in the instrumental analysis of the drug.
- TC3. Identifying opportunities for continuous training and efficient use of learning resources and techniques for their own development.

✓ Study outcomes

Upon completion of the course the student will be able to:

- know: the particularities of the instrumental methods;
- know the criteria for selecting the instrumental method depending on the purpose of the research and the particularities of the drug substance;
- be able to identify the main types of errors in the experimental measurement process and minimize them;
- to draw conclusions on the quality of the product based on experimental data;
- apply instrumental analysis methods in pharmaceutical practice.

Note. **Study outcomes** (are deduced from the professional competencies and formative valences of the informational content of the discipline).

VIII. STUDENT'S SELF-TRAINING

No.	Expected product	Implementation strategies	Assessment criteria	Implementation terms
1.	Working with lecture materials, methodical indication	Work systematically in the library and mediate. Exploring the current electronic sources on the topic under discussion	1. Quality of formed judgments, logical thinking, flexibility. 2. The quality of the systematization of the informational material obtained through its own activity.	During the semester
2.	Report	Analysis of relevant sources on the topic of the paper. Analysis, systematization and synthesis of information on the proposed theme. Compilation of the paper according to the requirements in force and presentation to the chair.	1. The quality of systematization and analysis of the informational material obtained through its own activity. 2. Concordance of information with the proposed theme.	During the semester
3.	Case study analysis	Choice and description of the case study Analysis of the causes of the issues raised in the case study. Prognosis of the case investigated. Deduction of the expected outcome of the case.	1. Ability to analyze, synthesize, generalize data obtained through its own investigation. 2. Formation of an algorithm of knowledge based on the obtained conclusions.	During the semester

IX. METHODOLOGICAL SUGGESTIONS FOR TEACHING-LEARNING-ASSESSMENT

- ***Teaching and learning methods used***

Exposure, interactive lecture, heuristic conversation, problem-solving, brainstorming, group work, individual study, work with textbook and text, debate, problem solving, role play, simulation, interactive listening**.**

- ***Applied teaching strategies / technologies*** *(specific to the discipline)*

Inductive, deductive strategies, teaching and learning strategies are developed using models (***analogue strategies***), algorithmic strategies: explicative-demonstrative, intuitive, exponential, imitative and algorithmic; ***heuristic strategies*** - to develop knowledge through his or her own thinking effort, using problem-solving, discovery, modeling, hypothesis formulation, heuristic dialogue, investigative experiment, assault of ideas, which stimulate creativity.

- ***Methods of assessment*** *(including the method of final mark calculation)*

Current: front and / or individual control via:

(a) solving problems / exercises;
(b) analysis of case studies;
(c) control assesments – 2;
(d) the current assessment of self-training at the end of the semester.

The average mark is calculated by average of the marks obtained at control assesments and the mark of self-training.

Final: Colloquium, the "pass" rating – oral answer.

The final grade at *the colloquium* will be composed of the average score during the semester (50%), the oral answer (50%).

X. RECOMMENDED LITERATURE:

A. Compulsory:

1. Course support.
2. Bojiţă M.; Roman L.; Săndulescu R.; Oprean R. Analiza şi controlul medicamentelor. Vol. II. Metode instrumentale în analiza și controlul medicamentelor. - Cluj-Napoca: Ed. Intelcredo, Deva, 2003.
3. Muntean D.L.; Bojiţa M. Controlul medicamentelor. Metode spectrale, cromatografice și electroforetice de analiză. - Ed. Medicală universitară "Iuliu haţieganu", Cluj-Napoca, 2004.
4. Roman L.; Bojiţă M.; Săndulescu R. Validarea Metodelor de analiză şi control. - Ed. Medicală, 1998.
5. Methodical indications.

B. Additional:

1. British Pharmacopoeia. – London, 2014.
2. David V. Metode de separare şi de analiză a urmelor, capitolul IV: Spectrometria de masă. - Editura Universităţii Bucureşti, 2001.
3. European Pharmacopoeia. – 2014.
4. Farmacopea Română. Ediţia X-a –Bucureşti: Editura medicală, 1993.
5. Gocan S. Cromatografia de înaltă performanţă, partea a II-a: Cromatografia de lichide pe coloane. - Editura Risoprint, Cluj-Napoca, 2002.
6. Imre S., Muntean D.L., Molnar A. Impurităţi farmaceutice, Ed. University Press, Târgu Mureş, 2008.
7. Imre S.; Muntean D.L. Principii ale analizei medicamentului. - Ed. University Press, Târgu Mureş, 2006.
8. Roman L, Bojiţă M., Săndulescu R., Daniela Lucia Muntean Validarea Metodelor Analitice, Ed. Medicală 2007
9. Skoog D.A, West D.M, Holler. Fundamentals of analytical Chemistry 7^{ed} Saunder College Publishing, 1996.
10. http://www.scritub.com/management/marketing/Analiza-instrumentala1612417108.php
11. http://ph.academicdirect.org/CAI_2006.pdf