

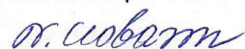


FACULTY OF PHARMACY

Approved

by the Council meeting of Faculty of
Pharmacy,
Minutes No. 4 of 13.06.2016

Dean of Faculty of Pharmacy,
Associate professor,



Nicolae Ciobanu

Approved

by the meeting of Department
of Pharmaceutical and Toxicological
Chemistry,
Minutes No. 10 of 11.05.2016

Head of Department, professor



Vladimir Valica

Syllabus

DISCIPLINE PHARMACEUTICAL CHEMISTRY

Name of the course: **PHARMACEUTICAL CHEMISTRY**

Code of the course: **S05O049, S06O058, S07O069, S08O075**

Type of course: **Compulsory**

Total number of hours – 323,

including lectures – 119 hours, practical lessons – 204 hours

Number of credits provided for the course – 18, including: 4 – colloquium (Pharmaceutical chemistry – I, sem. V); 4 – exam (Pharmaceutical chemistry – II, sem. VI); 10 – exam (Pharmaceutical chemistry –III, sem. VIII)

Lecturers teaching the course:

- PhD in Pharmaceutical Sciences, professor **Vladimir Valica**
- PhD in Pharmaceutical Sciences, Associate Professor **Livia Uncu**
- PhD in Pharmaceutical Sciences, Associate Professor **Tatiana Treapitina**

**I. Aim of the discipline:**

Discipline of Pharmaceutical Chemistry is included in the curriculum of the faculty of pharmacy in order to form a methodology for learning the methods of obtaining and assessing the quality of drug substances on the basis of general principles and particular pharmaceutical chemistry, to fulfil professional pharmacist.

II. Objectives obtained in teaching the discipline:

Pharmaceutical Chemistry is one of the discipline that studies the methods to obtain medicinal substances, their chemical and physical properties and the methods of analysis of medicinal substances.

III. Basic content of the course:

The discipline is studied at the 3rd and the 4th years.

A. Lectures:**Pharmaceutical Chemistry – I**

| <i>Semester V</i> | | |
|-------------------|--|-----------|
| No | Contents | Hours |
| 1. | Introduction. Pharmaceutical Chemistry, its content. Place of pharmaceutical chemistry in the complex of pharmaceutical sciences. Main stages of development of pharmaceutical chemistry. DAN for medicinal products (European Pharmacopoeia, pharmacopoeia monographs). Pharmaceutical Analysis: identification, determination of purity, methods of quantitative determination. | 4 |
| 2. | Medicinal substances. Inorganic compounds. Medicines of compounds of oxygen, halogens and their compounds with alkali metals. Medicines of compounds of calcium, magnesium, boron, zinc, aluminium, silver, iron, carbonates. | 8 |
| 3. | Medicinal substances. Aliphatic compounds. Analysis of halogens in organic substances. Derivatives of halogens of paraffin. Derivatives of ethers and alcohols, aldehydes and carbohydrates. Carboxylic acids, unsaturated fatty polioxicarboxylic acids, urethanes, ureid acyclic aminoacids and terpenoids. Calciferol, cardenolides, sexual hormones- male (androgens), anabolic gestagen, estrogens, corticosteroids. | 18 |
| 4. | Medicinal substances. Aromatic compounds. Phenol and quinone derivatives. | 4 |
| Total | | 34 |

Pharmaceutical Chemistry – II

| <i>Semester VI</i> | | |
|--------------------|---|-------|
| No | Contents | Hours |
| 1. | Medicinal substances. Aromatic compounds. P-aminophenol derivatives, aromatic and aminoaromatic acids. Iodinated derivatives of aromatic and arilalifatic aminoacids. Radiopharmaceutical medicine analysis. | 6 |
| | Antibacterial medicines. Characteristics, classification. The correlation between chemical structure and biological activity Antibacterial benzenesulfonilamides | 6 |
| | Medicinal substances. Heterocyclic compounds. Antibacterial drugs. Furan | 2 |



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| derivatives and 8-hydroxyquinoline. | |
| Medicinal substances. Antibacterial drugs. Antibiotics in the tetracycline group and nitrophenilalkilamines. | 2 |
| General characteristics and methods analysis of penicillins, natural and semisynthetic cephalosporins. Aminoglycosides. | 10 |
| Antifungal Grisan group, polyenic macrolides, antifungal synthetic (derivatives of imidazole and 1,2,4-triazole). Antiviral, antimycobacterial and antimalarial drugs. | 6 |
| Derivatives of and oxyphenilalkilamines and arilalkilamines. | 2 |
| Total | 34 |

Pharmaceutical Chemistry – III

| <i>Semester VII</i> | | |
|----------------------|--|-----------|
| No | Contents | Hours |
| 1. | Medicinal substances. Heterocyclic compounds. Diuretics and antidiabetic medicines. General characteristic. Classification. Structure – activity relationship. | 4 |
| | Benzopyran, pyrrole and indole derivatives. | 2 |
| | Imidazole and pyrazole derivatives. | 2 |
| | Pyridine, piperazine and tropane derivatives. | 4 |
| | Quinoline, isoquinoline, quinuclidine derivatives. | 4 |
| | Pyrimidine, pirimidino- thiazole and purine derivatives. | 8 |
| | Izoaloxazine and pteridine derivatives. | 2 |
| | Psychotropic drugs - antipsychotics, anxiolytics, and antidepressants. | 8 |
| <i>Semester VIII</i> | | |
| 2. | Pharmaceutical forms. Chemical methods of identification, determination of purity and dosage of drugs. | 6 |
| | Drug substances combination in pharmaceutical forms. Particularities of analysis and control. | 11 |
| Total | | 51 |

B. Practice lessons:

Pharmaceutical Chemistry – I

| <i>Semester V</i> | | |
|-------------------|---|-------|
| No | Contents | Hours |
| 1. | Quality criteria and general methods of analysis of drug substances. Organization of quality control of medicines. Technical documentation. Standards of quality control of medicines. Importance of indexes "Description" and "Solubility" in pharmaceutical analysis. | 3 |
| 2. | Analysis of drug substances following pharmacopoeial monographs – inorganic substances. Oxygen compound derivatives. Common reactions of identification of inorganic substances. Determination of the purity of drug substances and limit of impurities. | 3 |
| | Halogen compounds derivatives and their alkali metal compounds. | 3 |
| | Derivatives of calcium, magnesium, boron, aluminum compounds, carbonate. | 3 |



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| | Determination of layout solutions: transparency and degree of turbidity, staining solutions. | |
| | Derivatives of zinc, silver, iron, platinum compounds. Determination of volatile of substances and water in drug substances. <i>Final practical work.</i> | 6 |
| 3. | Analysis of drug substances following pharmacopoeial monographs – aliphatic substances. Peculiarities of analysis of organic medicinal substances. Paraffin derivatives and their halogen derivatives. Analysis of halogenated organic substances. Determination of density of liquids. | 3 |
| | Ether, alcohols, aldehydes and carbohydrates, carboxylic acids derivatives. Determination of pH of the solution, the melting point of medicinal substances. Common reactions of identification of organic substances. | 6 |
| | Aminoacids derivatives. <i>Final practical work.</i> | 6 |
| 4. | Analysis of drug substances following pharmacopoeial monographs –cyclic substances. Terpenoids derivatives. | 3 |
| | Ciclopentanperhidrophenantren derivatives: calciferol, cardenolide, androgens and anabolic, gestagen, estrogens and corticosteroids. | 12 |
| | Final practical work and test. | 3 |
| Total | | 51 |

Pharmaceutical Chemistry – II

| <i>Semester VI</i> | | |
|--------------------|--|-----------|
| No | Contents | Hours |
| 1. | Analysis of drug substances following pharmacopoeial monographs –aromatic substances. General characteristics of aromatics. Phenol and quinones derivatives. Estrogen compounds with nonsteroid structure. Drug with quinone group and p-aminophenol, p-aminophenol and quinones, aromatic acids. | 9 |
| | Medicines p-aminosalicilic and o-aminobenzoic acid group. Medicines iodide derivatives of aromatic and arilaliphatic aminoacids. <i>Final practical work.</i> | 9 |
| 2. | Analysis of drug substances following pharmacopoeial monographs – antibacterials. Antibacterial drugs. Antibacterial benzenesulfanilamides and their derivatives. | 3 |
| | Antibacterials from furan and 8 hydroxyquinoline group derivatives. Antibiotics in the tetracycline and nitrofenilalchilamine group. <i>Final practical work.</i> | 9 |
| | Betalactamides (penicillins and cephalosporins, natural and semi-synthetic). Monobactams, carbapenems. Aminoglycosides, polypeptides, lincosamines, macrolides. Antifungal Grisan group, polyenic macrolides, antifungal synthetic (derivatives of imidazole and 1,2,4-triazole). Antiviral drugs, antimycobacterial and antimalarial. | 12 |
| 3. | Final practical work. Practical skills assessment. | 9 |
| Total | | 51 |

Pharmaceutical Chemistry –III

| <i>Semester VII</i> | | |
|---------------------|----------|-------|
| No | Contents | Hours |



| | | |
|---------------------------------------|---|------------|
| 1. | Analysis of drug substances following pharmacopoeial monographs– aromatic substances. Phenylalkylamines group medicines, arilhidroxypropanolamines. | 6 |
| | Diuretic drugs. General characteristic. Classification. Structure - activity relationship. | 3 |
| | Antidiabetic drugs. General characteristic. Classification. Structure - activity relationship. | 3 |
| 2. | Analysis of drug substances following pharmacopoeial monographs– heterocyclic substances. Benzopyran group derivatives medicines. <i>Final practical work.</i> | 6 |
| | Medicine of pyrrole and indole derivatives. | 3 |
| | Medicine of the imidazole and pyrazole derivatives. | 3 |
| | Medicine of pyridine derivatives. <i>Final practical work.</i> | 6 |
| | Medicine of tropane, quinoline and quinuclidine derivatives. | 6 |
| | Medicine of isoquinoline derivatives. | 6 |
| | Medicines of pyrimidine derivatives. | 3 |
| Final practical work and test. | | 6 |
| <i>Semester VIII</i> | | |
| 3. | Monographic analysis of drug substances – heterocyclic. Medicines of pirimidino thiazole derivatives. | 6 |
| | Medicines of purine derivatives. | 3 |
| | Medicines of izoaloxazines and pteridines derivatives. | 3 |
| | Psychotropic drugs - neuroleptics, anxiolytics, antidepressants. <i>Final practical work.</i> | 9 |
| 4. | Main pharmaceutical forms. Chemical methods of identification, determination of purity and dosage of drugs. Peculiarities analysis and control. | 24 |
| 5. | Final practical work. Practical skills assessment. | 6 |
| Total | | 102 |

IV. Recommended literature:**A. Compulsory:**

1. Babilev F.V. Chimie farmaceutică, Chişinău: Universitas, 1994.- 675 p.
2. Bojiţă M., Roman L., Săndulescu R., Oprean R. Analiza şi Controlul medicamentelor.Vol. I. - Cluj-Napoca: Editura Intelcredo, 2003. – 495 p.
3. Bojiţă M., Roman L., Săndulescu R., Oprean R. Analiza şi Controlul medicamentelor.Vol. II. - Cluj-Napoca: Editura Intelcredo, 2003. – 768 p.
4. Haţieganu E., Stecoza C. Chimie terapeutică. Vol. II. – Bucureşti: Editura Medicala, 2006-2008. – 253 p.
5. Беликов В.Г. Фармацевтическая химия.- М.: МЕДпресс-информ, 2007. – 624 с.
6. Вартанян Р.С. Синтез основных лекарственных средств. – М.:МИА, 2004. – 844 с.
7. Руководство к лабораторным занятиям по фармацевтической химии. Под ред. Арзамасцева А.П. – М.: Медицина, 2001. – 384 с.
8. Фармацевтическая химия. Под ред. Арзамасцева А.П. – М.: ГЭОТАР-Медиа, 2006. – 640 с.
9. Lecture notes
10. Methodic indications.

B. Additional:

1. Farmacopea Română. Ediția X-a –Bucureşti: Editura medicală, 1993.-1315p.



2. Lista medicamentelor esențiale. Ordinul MS RM Nr. 162 din 23.04.07.
3. Matcovschi C., Safta V. Ghid farmacoterapeutic (medicamente omologate în Rep. Moldova). – Ch.: „Vector V-N” SRL, 2010 (F.E.-P. „Tipor. Centrală”). – 1296 p.
4. Государственная Фармакопея Республики Беларусь. Первое издание, - Минск, 2006.
5. European Pharmacopoeia 7.0, Ed. EDQM, (Electronic), 2010.
6. British Pharmacopoeia. – London, 2009.

V. Teaching and learning methods:

Course, practical work.

VI. Suggestions for individual work:

Reading of additional literature, individual consultations, thematic reports, thematic conferences.

VII. Methods of assessment:

Current: during the course, test-control, observation sheet, colloquium;

Final: colloquium on pharmaceutical chemistry-I (test-control, oral) and exams (pharmaceutical chemistry-II and pharmaceutical chemistry-III) in 3 steps-certification, practical skills, test-control and oral.

Method of mark rounding

| The average of current and final marks | Final mark | Equivalent ECTS |
|--|------------|-----------------|
| 1,00-3,00 | 2 | F |
| 3,01-4,99 | 4 | FX |
| 5,00 | 5 | E |
| 5,01-5,50 | 5,5 | |
| 5,51-6,0 | 6 | |
| 6,01-6,50 | 6,5 | D |
| 6,51-7,00 | 7 | |
| 7,01-7,50 | 7,5 | C |
| 7,51-8,00 | 8 | |
| 8,01-8,50 | 8,5 | B |
| 8,51-8,00 | 9 | |
| 9,01-9,50 | 9,5 | A |
| 9,51-10,0 | 10 | |

Absence on examination without good reason is recorded as „absent” and is equivalent to 0 (zero). The student has the right to re-take the failed exam twice.

VIII. Language of study:

Romanian.