

**MEDICAL UNIVESRITY – PLOVDIV**  
**FACULTY OF PHARMACY**  
**DEPARTMENT OF PHARMACEUTICAL SCIENCES**

# **SYLLABUS**

**in**

## **DRUG DELIVERY SYSTEMS**

**Approved by the Department Council - Protocol № 10/18.10.2024**

**Confirmed by the Faculty Council - Protocol № 09/13.11.2024**

## DRUG DELIVERY SYSTEMS

### Syllabus

Discipline	Final exam/ semester	According to the Faculty of Pharmacy curriculum of MU-Plovdiv Academic hours				ECTS	Academic hours in semester	
		Auditorium	Lectures	Practices	Non-auditorium		IX semester	
							L	P
Drug delivery systems	IX	20	12	8	30	2	12	8

**DISCIPLINE:**

Drug delivery systems

**TYPE OF DISCIPLINE ACCORDING TO THE UNIFORM STATE REQUIREMENTS:**

Optional

**LEVEL OF QUALIFICATION:**

MPharm

**FORMS OF TRAINING:**

Lectures, practicals

**YEAR OF TRAINING:**

V course

**DURATION OF TRAINING:**

One semester

**ACADEMIC HOURS:**

12 hours lectures, 8 hours practicals

**TECHNICAL EQUIPMENT APPLIED IN THE TRAINING:**

Multimedia presentations, discussions, individual tasks, preparation of papers

**FORMS OF EVALUATION:**

- Current assessment during the semester
- Semester exam

**SEMESTER EXAM:**

An average mark is formed on the basis of the grades from the current assessments during the semester and the theoretical exam.

**STATE EXAM:**

No

**LECTURER:**

Professor or assistant professor from the department of Pharmaceutical sciences.

**DEPARTMENT:**

Pharmaceutical sciences

**ANNOTATION**

The course is based on basic knowledge in pharmaceutical science and expands and deepens the knowledge about the development and production of innovative dosage forms in order to prepare students for experimental research and industrial pharmaceutical activities on the subject. The following topics are covered in the course:

- Characterization of the physical properties of solid particles: solid state analysis, particle size analysis and particle statistics, shape analysis, surface area, mechanical properties.
- Principles of formulation of controlled/optimized drug release and absorption: systems for nasal, pulmonary and dermal drug administration and basic physiological aspects of the pharmaceutical formulations.
- Formulation, stabilization and lyophilization of protein-targeting drugs and their optimized application.

**BASIC AIMS OF THE DISCIPLINE**

This course is designed to provide knowledge and skills, which are needed to train students in the field of new drug delivery systems.

**EXPECTED RESULTS**

After completing the course students must:

- know the basic methods for characterization of solid structures, size, shape, porosity and pore structure of the particles;
- can independently develop a system for controlled/optimized drug release and absorption;
- create stable and optimized innovative drug delivery systems.

**SYLLABUS**  
**V course, IX semester**

<b>№</b>	<b>TOPIC</b>	<b>HOURS</b>	<b>FORM OF EDUCATION</b>
1.	Concept and models of drug delivery systems.	2 h.	lecture
2.	Alternative routes of drug administration.	2 h.	lecture
3.	Targeted drug delivery systems.	2 h.	lecture
4.	Protein/peptide delivery systems.	2 h.	lecture
5.	Biotechnology in drug delivery systems. Vaccines.	2 h.	lecture
6.	New trends for personalized medicine.	2 h.	lecture
7.	Development and characterization of delivery systems based on particle design – I.	4 h.	practical
8.	Development and characterization of delivery systems based on particle design – II.	4 h.	practical

**TOTAL: 20 h.**

## LECTURES – THESES

### *LECTURE № 1 – 2 hours*

#### **CONCEPT AND MODELS OF DRUG DELIVERY SYSTEMS.**

1. Classification of the drug delivery systems (DDS).
2. Carriers for drug delivery – polymers, proteins.
3. Mucoadhesive DDS (buccal, nasal, pulmonary).
4. Stimuli-sensitive DDS.
5. Gastroretentive DDS.

### *LECTURE № 2 – 2 hours*

#### **ALTERNATIVE ROUTES OF DRUG ADMINISTRATION.**

1. Nasal DDS.
2. Pulmonary DDS.
3. Transdermal DDS.
4. Intrauterine DDS.
5. DDS for colon delivery.

### *LECTURE № 3 – 2 hours*

#### **TARGETED DRUG DELIVERY SYSTEMS.**

1. Significance, concept, biological process and events related to the targeted action of drugs.
2. Methods for design, formulation and research in targeted drug delivery systems – nanoparticles, liposomes, niosomes, pharmacosomes, microspheres, magnetic microspheres.
3. Specialized pharmaceutical emulsions – multiple emulsions, micro-emulsions.

### *LECTURE № 4 – 2 hours*

#### **PROTEIN/PEPTIDE DELIVERY SYSTEMS.**

1. Concepts.
2. Delivery techniques.
3. Formulation.
4. Stability test, causes of protein instability, stabilization methods.

### *LECTURE № 5 – 2 hours*

#### **BIOTECHNOLOGY IN DRUG DELIVERY SYSTEMS. VACCINES.**

1. A brief overview of the main areas.
2. Recombinant DNA technology.
3. Monoclonal antibodies, ADC conjugates, aptamers.
4. Gene therapy.
5. Review of conventional vaccine production (BCG, smallpox, typhoid, cholera, polio, etc.)
6. Principles of multivalent subunit vaccines, synthetic peptide vaccines, recombinant antigenic vaccines, vector vaccines, etc.

***LECTURE № 6 – 2 hours***

**NEW TRENDS FOR PERSONALIZED MEDICINE.**

1. Introduction, definition.
2. Pharmacogenetics.
3. Patient categories for personalized medicines.
4. Customized drug delivery systems.
5. Bioelectronic drugs.
6. 3D printing of pharmaceutical products.
7. Telepharmacy.

**PRACTICALS – THESES**

***PRACTICAL № 1 – 4 hours***

**DEVELOPMENT AND CHARACTERIZATION OF DELIVERY SYSTEMS BASED ON PARTICLE DESIGN – I.**

1. Preparation of delivery systems with sustained and controlled drug release (microspheres).
2. Particle size analysis and size distribution.
3. Infrared spectroscopy.
4. Electron microscopy (SEM and TEM).

***PRACTICAL № 2 – 4 hours***

**DEVELOPMENT AND CHARACTERIZATION OF DELIVERY SYSTEMS BASED ON PARTICLE DESIGN – II.**

1. Preparation of delivery systems with sustained and controlled drug release (microcapsules).
2. Particle size analysis and size distribution.
3. Infrared spectroscopy.
4. Electron microscopy (SEM and TEM).

## BIBLIOGRAPHY

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2. *Applied Physical Pharmacy, Third Edition*, Mansoor Amiji, Thomas Cook, Cary Mobley, McGraw Hill
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4. *Pharmaceutical Dosage Forms and Drug Delivery: Revised and Expanded; 3rd Edition*, Ram I. Mahato, Ajit S. Narang, CRC Press
5. *Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems*, Loyd Allen, Wolters Kluwer
6. *Pharmaceutical Compounding and Dispensing Second edition*, John Marriott, Keith Wilson, Christopher Langley, Dawn Belcher, Pharmaceutical press
7. *Handbook of Extemporaneous Preparation First edition*, Mark Jackson, Andrew Lowey, Pharmaceutical press
8. *The Art, Science, and Technology of Pharmaceutical Compounding 5th Edition*, Loyd Allen, American Pharmacists Association
9. *Applied Biopharmaceutics & Pharmacokinetics*, Leon Shargel, McGraw Hill
10. *Pharmaceutics – Drug Delivery and Targeting 2E*, Perrie & Rades, Pharmaceutical press
11. *Basic Statistics and Pharmaceutical Statistical Applications 3rd Edition*, James E. De Muth, CRC Press
12. *Pharmaceutical Calculations, 15th Edition*, Howard Ansel; Shelly Stockton, Wolters Kluwer
13. *Cosmetic Formulation: Principles and Practice 1st Edition*, Heather Benson, Michael Roberts, Vania Rodrigues Leite-Silva, Kenneth Walters, CRC Press
14. *Martin's Physical Pharmacy and Pharmaceutical Sciences Seventh Edition*, Patrick J.Sinko, LWW
15. *Modern Pharmaceutics, Two Volume Set 5th Edition*, Alexander Florence, Juergen Siepmann, CRC Press
16. *Physicochemical Principles of Pharmacy: In Manufacture, Formulation and Clinical Use 6-th edition*, Alexander Florence; David Attwood, Pharmaceutical Press
17. *Essentials of Biopharmaceutics and Pharmacokinetics, 2/e*, Ashutosh Kar, CBS Publishers & Distributors
18. *Handbook of Pharmaceutical Excipients 8th Revised edition*, Edited by Paul Sheskey, Walter Cook, Colin G. Cable, Pharmaceutical Press
19. *Access Pharmacy*, <https://accesspharmacy.mhmedical.com/>

**CONSPECTUS**  
**Drug delivery systems**

1. Concept and models of drug delivery systems.
2. Alternative routes of drug administration.
3. Targeted drug delivery systems.
4. Protein/peptide delivery systems.
5. Biotechnology in drug delivery systems.
6. Vaccines.
7. New trends in personalized medicine.