



MEDICAL UNIVERSITY – PLOVDIV

FACULTY OF PHARMACY

SYLLABUS

IN

MODELS IN PHARMACY

Approved by the Department Council, Protocol №17/23.6.2026

Confirmed by the Faculty Council, Protocol №7/15.07.2026

MODELS IN PHARMACY

Syllabus

Discipline	Final exam/ semester	According to the Faculty of Pharmacy curriculum of MU-Plovdiv Academic hours				ECTS	Academic hours in semester			
							III semester		IV semester	
		Auditorium	Lectures	Practices	Non-auditorium		L	P	L	P
Models in Pharmacy	IV	40	30	10	40	3,0	1	1	1	1

DISCIPLINE:

Models in Pharmacy

TYPE OF DISCIPLINE ACCORDING TO THE UNIFORM STATE REQUIREMENTS:

Elective

LEVEL OF QUALIFICATION:

Master

FORMS OF TRAINING:

Lectures, seminars, self-training

YEAR OF TRAINING:

Second

DURATION OF TRAINING:

Two semesters (III и IV)

ACADEMIC HOURS:

30 academic hours of lectures, 10 academic hours of seminars

TECHNICAL EQUIPMENT APPLIED IN THE TRAINING:

Multimedia presentations, discussions, demonstrations of software products, development of specific assignments, preparation for developing a coursework.

FORMS OF EVALUATION:

Developing and defending coursework.

EVALUATION CRITERIA:

A final grade is formed from two components - an assessment of the coursework submitted and an assessment of its defense, taking into account the student's participation in the learning process.

ASPECTS OF EVALUATION CRITERIA:

The student's participation and work in classes, and the quality of their courseworks.

SEMESTER EXAM:

Yes

STATE EXAM:

No.

LECTURER:

Professor of Mathematics

DEPARTMENT:

Medical Physics and Biophysics

ANNOTATION

To help us better understand our world, we often describe a particular phenomenon mathematically (by means of a function or equation, for example). Such a description is called a model. Any model is an idealization of the real world and is never a completely accurate representation, due to the complexity of reality. However, good modelling can be a prerequisite for valuable results and conclusions. Modelling can be used for a number of different reasons. How well a particular goal is achieved depends both on the state of knowledge about a given system and on how well the model is made. The use of modelling techniques is becoming increasingly common in pharmaceutical science and industry, covering a wide range of application areas.

BASIC AIMS OF THE DISCIPLINE

The course "Models in Pharmacy" builds on the knowledge and skills acquired in the mandatory courses "Advanced Mathematics", "Information and Digital Technology" and "Statistical Methods in Pharmacy", applying them in the development and analysis of more complex quantitative models in pharmaceutical sciences. The discipline expands the students' competencies in mathematical and statistical modelling of pharmaceutical processes, interpretation of results, and use of modern digital tools to solve practical and research problems.

EXPECTED RESULTS

Upon completion of the training, students should have the following knowledge and skills:

- to know basic theoretical facts related to concepts, methods and models for the interpretation of living systems;
- to be familiar with various mathematical models, their characteristics and applications;
- to be familiar with the basic methods of statistical data analysis and be able to apply them;
- to be able to use analytical approaches that underlie the theory of statistical modelling.
- to be able to use supporting mathematical literature, statistical software and applications for data extraction, processing and analysis.

LECTURES

1. Introduction to modelling in pharmacy **(2 h)**
 - 1.1. Role of mathematical and statistical models
 - 1.2. Stages in building a model
 - 1.3. Types of models in pharmacy and medicine
2. Multiple linear regression and predictor selection **(5 h)**
 - 2.1. Multiple regression models
 - 2.2. Variable selection
 - 2.3. Model diagnostics
3. Nonlinear regression models **(4 h)**
 - 3.1. Nonlinear dependencies
 - 3.2. Polynomial models
 - 3.3. Exponential models
 - 3.4. Logarithmic models
4. Logistic regression **(4 h)**
 - 4.1. Binary outcomes
 - 4.2. Odds ratio
 - 4.3. Model quality assessment
5. Poisson regression and modelling of countable data **(3 h)**
 - 5.1. Countable data
 - 5.2. Frequencies and incidence
 - 5.3. Applications in pharmacy
6. Survival analysis **(4 h)**
 - 6.1. Censored data
 - 6.2. Kaplan-Meier curves
 - 6.3. Log-rank test
 - 6.4. Cox regression
7. Modelling repeated measures and longitudinal data **(4 h)**
 - 7.1. Longitudinal data
 - 7.2. Repeated measures
 - 7.3. Applications in pharmaceutical research
8. Modern methods for data analysis, machine learning and artificial intelligence in pharmacy **(4 h)**

- 8.1. Data mining
- 8.2. Machine learning
- 8.3. Applications of artificial intelligence in pharmacy

SEMINARS

1. Building and estimating multiple linear regression models **(2 h)**
 - 1.1. Predictor selection and model specification
 - 1.2. Model parameter estimation
 - 1.3. Interpretation and forecasting using multiple linear regression
2. Nonlinear regression models and dependency modelling **(1 h)**
 - 2.1. Building polynomial models
 - 2.2. Exponential and logarithmic dependencies
 - 2.3. Comparing linear and nonlinear models
3. Logistic regression and binary outcome modelling **(2 h)**
 - 3.1. Building logistic regression models
 - 3.2. Interpreting coefficients and odds ratios
 - 3.3. Assessing the quality of logistic models
4. Poisson regression and modelling countable data **(1 h)**
 - 4.1. Modelling countable data
 - 4.2. Interpretation of frequencies and incidence
 - 4.3. Applications in medical and pharmaceutical research
5. Survival analysis **(2 h)**
 - 5.1. Construction and interpretation of Kaplan–Meier curves
 - 5.2. Comparison of groups using the log-rank test
 - 5.3. Interpretation of Cox models
6. Modelling of repeated measures and longitudinal data **(1 h)**
 - 6.1. Analysis of repeated measures data
 - 6.2. Interpretation of longitudinal data
 - 6.3. Applications in pharmaceutical research
7. Modern methods for data analysis, machine learning and artificial intelligence in pharmacy **(1 h)**
 - 7.1. Examples of knowledge extraction from data
 - 7.2. Applications of machine learning in pharmaceutical data analysis
 - 7.3. Analysis of real cases from pharmacy and healthcare

BIBLIOGRAPHY

1. **F. Giordano, W. Fox, S. Horton.** *A first course in mathematical modeling*, Brooks/Cole, 2013.
2. **S. Banerjee.** *Mathematical modeling. Models, analysis and applications*, CRC Press, 2014.
3. **C. Cobelli, E. Carson.** *Introduction to modeling in Physiology and Medicine*, Academic Press, Elsevier, 2019.

Other textbooks and handbooks intended for non-specialist students in Modelling with applications in Medicine and Pharmacy can also be used to some extent.

CONSPECTUS

1. Role of mathematical and statistical models in pharmacy. Stages in model building. Types of models and areas of application.
2. Multiple linear regression. Selection of predictors, diagnostics and evaluation of regression models.
3. Nonlinear regression models. Polynomial, exponential and logarithmic dependencies. Applications in pharmacy.
4. Logistic regression. Modelling of binary outcomes, interpretation of odds ratios and assessment of model quality.
5. Poisson regression and modelling of countable data. Analysis of frequencies and incidence. Applications in pharmaceutical research.
6. Survival analysis. Censored data, Kaplan–Meier curves, log-rank test and Cox regression.
7. Modelling of repeated measures and longitudinal data. Features and applications in pharmaceutical and clinical studies.
8. Modern methods for data analysis. Data mining, machine learning and applications of artificial intelligence in pharmacy.

Prepared by:

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