1. COURSE DECRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Full Professor Juraj Šiftar, PhD,	1.6. Year of study	1st
1.2. Name of the course	**Mathematics with statistical analysis**	1.7. Credit value (ECTS)	7.5
1.3. Associate teachers	/	1.8. Type of instruction (number of hours L+E+S+e-learning)	45+0+30
1.4. Study programme (undergraduate, graduate, integrated)	Integrated study of pharmacy	1.9. Expected enrolment in the course	130
1.5. Status of the course	Compulsory	1.10. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	2nd

2. COURSE DESCRIPTION	
2.1. Course objectives	Introduction to basic terms, methods and applications of differential and integral calculus of functions of a real variable. Functional flow analysis and solving basic types of ordinary differential equations. Applying acquired knowledge in mathematical modeling of biological, chemical and physical processes. Adopting basic terms of probability theory and statistics. Processing and displaying congregation data and determination of statistical properties. Describing random processes by suitable distribution. Statistical hypothesis testing and assessing the reliability of results.
2.2. Enrolment requirements and required entry competences for the course	/
2.3. Learning outcomes at the level of the study programme to which the course contributes	Apply fundamental knowledge in mathematics and statistics (developing skills for problem formulation, using suitable methods for describing and analysing data, prediction of process flow by modelling) to define, analyse and propose procedures related to the research, development and production as well as analysis and quality control of pharmaceuticals.
2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)	After completing the course, student will be able to: 1. Recognize and use basic mathematical terms and symbols; 2. Identify elementary functions and their essential characteristics; 3. Define key terms of mathematical analysis (convergence, continuity, derivative, integral) and interpret them

	using examples; 4. Analyse flow and display of a function graph by methods of differential calculus; 5. Solve basic types of ordinary differential equations; 6. Formulate and interpret mathematical models of processes in the field of biology, chemistry and physics; 7. Select a suitable probability law or type of distribution for analysis of random processes; 8. Select a data set, determine its statistical features and display results; 9. Conduct an appropriate statistical test and assess reliability of results.
2.5. Course content broken down in detail by weekly class schedule (syllabus)	LECTURES: • Introduction to course content. An example of mathematical model in biology. • Some basic terms and symbols (sets, the set of real numbers - R, number line, intervals in R, set operations). Some terms of mathematical logic. Definition and basic characteristics of functions. • Series and their characteristics. Geometric series. Monotone and bounded series. Definition of convergence and limes. Accumulation of series. • Operation with convergent series. Some sufficient conditions of convergence. Number “e” as limes of series. • Row. Definition of convergence and row sum. Examples. Necessary condition of convergence. Criteria of convergence. • Functions. Natural domain and image of a function. Composition. Inverse function. Graph of a function. Review of elementary functions. Polynomials. Rational functions. Exponential and logarithmic functions. Trigonometric and arcus functions. • Periodicity. • Limes of a function. Continuity of a function. Characteristics of continuous functions. • Derivative of a function. Problem of speed and tangent. Basic rules of derivation. Derivation of elementary functions. • Logarithmic derivation. Higher order derivatives. L'Hospital's Rule. Mean value theorem. • Application of a derivation – extrema, function flow. Differential linear approximation. Taylor series. • Real functions of several variables. Partial derivatives. Extrema of functions of several variables. • Definition of primitive function. Indefinite integral. Review of basic indefinite integrals. • Methods of integration – directly, substitution, partial integration. Integrals of rational functions. • Area problem. Definite integral. Newton-Leibniz formula. Applications: Volume and area of rotating body; Length of the arc of a curve; Not a real integral. • Definition of differential equations. Differential equations with separate variables. First order linear differential equations and second order equations with constant coefficients. • Basic terms of combinatorics. Definition of probability. Probability of complex events. Conditional probability. • Random variables - discrete and continuous. Probability density and distribution functions. • Distributions of random variables – binomial, Poisson, normal.

<table>
<tr><td></td><td colspan="6">

Theory of samples. Measurement and data collection. Representation of a frequency distribution. Measures of central tendency and variability of data.
Parameter estimation, confidence interval. Testing of statistical hypotheses, statistical test, errors.
Two-dimensional statistical models, correlation coefficient, regression line, least squares method.

SEMINARS (mathematical tasks):

Series. Testing of properties. Testing of convergence. Determination of limes and accumulation.
Rows. Testing of convergence and divergence. Calculating the sum of convergent series. Application of convergence criteria.
Determination of natural domain and function image. Composition of functions. Periodicity. Exponential and logarithmic functions.
Limes functions. Continuous functions. Points of interruption. Asymptote.
Derivation. Basic rules of derivation. Higher order derivatives. Application of a derivation. Extrema. Flow and graph of function. L'Hospital's Rule. Functions of several variables. Partial derivatives. Extrema.
Primitive function and indefinite integral. Basic methods of integration. Definite integral. Newton-Leibniz formula. Applications (area and volume of rotating body, length of the arc of a curve).
Differential equations - equations with separate variables, first order linear equations and second order equations with constant coefficients.
Basic combinatorial assignments. Basic terms of probability. Random variables.
Theory of samples, graphical and tabular presentation of frequency distribution. Measures of central tendency and variability in data. Parameter estimation, confidence interval.
Testing of statistical hypotheses, statistical test, errors.

</td></tr>
<tr><td>2.6. Type of instruction</td><td colspan="2"><u>lectures</u>
<u>seminars</u> and workshops
exercises
online in entirety
mixed e-learning
field work</td><td colspan="2">independent study
multimedia and the internet
laboratory
work with the mentor
(other)</td><td colspan="2">2.7. Comments:
In seminars students actively participate in the elaboration of appropriate examples and solve mathematical tasks.</td></tr>
<tr><td>2.8. Student responsibilities</td><td colspan="6"></td></tr>
<tr><td rowspan="5">2.9. Screening of student’s work (specify the proportion of ECTS credits for each activity)</td><td>Class attendance</td><td>1.5</td><td>Research</td><td></td><td>Practical training</td><td></td></tr>
<tr><td>Experimental work</td><td></td><td>Report</td><td></td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td>Seminar essay</td><td>1.5</td><td>(Other--describe)</td><td></td></tr>
<tr><td>Tests</td><td></td><td>Oral exam</td><td></td><td>(Other—describe)</td><td></td></tr>
<tr><td>Written exam</td><td>4.5</td><td>Project</td><td></td><td>(Other—describe)</td><td></td></tr>
<tr><td>2.10. Grading and evaluation of student work over the course of instruction and at a final exam</td><td colspan="6">Two partial exams during semester or written exam after the end of the semester.</td></tr>
<tr><td>2.11. Required literature (available at the</td><td colspan="6">Title</td></tr>
</table>

library and via other media)	D. Bakić. Mathematics for biologists, http://web.math.hr/~bakic/teach.html		
	P. Javor; Introduction to mathematical analysis, Školska knjiga, Zagreb		
	B. Petz: Basic statistical methods for non-mathematicians. 3rd revised edition. Jastrebarsko: Naklada Slap; 1997		
2.12. Optional literature	B. P. Demidovič: Assignments and solved examples of mathematical analysis for technical faculties, Croatia knjiga, Zagreb		
2.13. Methods of monitoring quality that ensure acquisition of exit competences	Learning objectives are validated by written exams and during seminars.		