

Course Title	Mathematics and Elements of Statistics				
Course Code	PHA103				
Course Type	Compulsory				
Level	BSc (Level 1)/ MPharm (Level 2)				
Year / Semester	1 st (2 nd Semester)				
Teacher's Name	Dr. Yiannis Parpottas				
ECTS	6	Lectures / week	3+1*	Laboratories/week	-
Course Purpose	<p>The aim of this course is to provide an overview and understanding of mathematical concepts essential to the practice of the scientist in pharmaceutical and health sciences. Subjects that will be covered include of analytical geometry, elements of linear algebra, function limits and continuity, derivatives, integrals and applications in physicochemical problems. In addition, the course includes an introduction to probability theory and statistical analysis aiming to provide to the students the capability of evaluating statistical outcomes resulting from studies (clinical, experimental etc) related to health and life sciences.</p> <p>*tutorial</p>				
Learning Outcomes	<p>By the end of the course, students must be able to:</p> <p>Elements of Set theory</p> <p>Recognize the mathematical symbolism and basic operations of set theory such as those used to denote the union of two or more sets, intersections, formation of subsets etc.</p> <p>Perform elementary calculations with sets, in order to solve simple classification problems relevant to health sciences.</p> <p>Elements of Linear Algebra</p> <p>Interpret the symbolism of matrix algebra and specifically the representation of linear systems of equations in terms of matrices.</p> <p>Perform the basic matrix operations of addition, subtraction, inversion and multiplication.</p> <p>Calculate the determinant and the inverse of a matrix using the minors and the adjoint matrix.</p> <p>Apply Cramer's rule and Gaussian elimination for the solution of linear systems of equation.</p> <p>Elements of analytic geometry and vector calculus</p>				

Define vectors using Cartesian or polar coordinate systems.

Recognize the geometric interpretation and the properties of the allowed types of operations: addition, subtraction, multiplication by a scalar, inner and outer product.

Apply vector operations in order to solve simple problems.

Recognize the equations of a straight line, the circle and the ellipse and their key features.

Apply analytic geometry using straight lines, circles or ellipses to problems related to health sciences.

Elements of Differential and Integral Calculus

Interpret the symbolism used to denote the limits of functions.

Identify the limits and points of discontinuity of a function through graphical representation.

Describe the derivative as the limit of a ratio and as the local rate of change of a function.

Calculate the derivative of elementary functions: polynomials, trigonometric, exponential and logarithmic functions.

Use the rules of differentiation: product rule, division and chain rule

Apply the derivative as the slope of the tangent to a curve and as the local rate of change to problems involving maxima and minima.

Calculate the indefinite integral of elementary functions: polynomials, trigonometric, exponential and logarithmic functions.

Explain the fundamental theorem of calculus.

Apply the method of integration by substitution and by parts to integrals of rational functions.

Apply the integral to the calculation of the area between functions and to the volume of revolution in physiochemical problems.

Elements of Statistics

Use the basic elements of descriptive statistics: tables, graphs and histograms for the qualitative description of statistical data.

Calculate measures of central tendency and dispersion of a statistical sample.

Gain familiarity with the fundamentals of probability theory: basic definitions, conditional probability, permutations and combinations.

Solve problems involving probability on sets of sampled data.

Recognize random variables and the importance of the expectation value and variance.

	<p>Identify the key distribution functions and their importance to the description of actual problems.</p> <p>Perform calculations of probability using discrete and continuous distribution functions.</p> <p>Recognize the concept of the sampling distribution and the importance of the central limit theorem.</p> <p>Calculate the confidence interval in applications related to health sciences.</p>		
Prerequisites	None	Corequisites	None
Course Content	<p>Elements of set theory: set operations, Cartesian product, relations and functions.</p> <p>Elements of linear algebra: Matrices and matrix operations, the determinant and the inverse matrix, Cramer's rule, Gaussian elimination, analysis and solution of systems of linear equations.</p> <p>Elements of Analytic Geometry: Introduction to vectors and vector operations (inner and outer product), the equation of the straight line and the conics.</p> <p>Elements of Differential and Integral Calculus: Limits of functions, continuity, the derivative and the rules of differentiation, applications in the calculation of maxima and minima, definite and indefinite integrals, applications of integration.</p> <p>Elements of Statistics: Measures of Central Tendency and Dispersion, graphical representation of statistical measurements, elements of probability theory, introduction to distribution functions, confidence intervals.</p> <p>Applications of the above in the field of Pharmacy through tutorial sessions.</p>		
Teaching Methodology	<p>The course is taught through lectures in classrooms or lectures theatres, mostly by means of computer demonstration (power-point presentations). In addition one (1) per week is devoted to tutorial sessions, which involves solving exercises and problems aiming both in the understanding and application of the theory to problems relevant to the field of health sciences.</p> <p>The power point presentations are available for download at the course e-learning page. The notes are separated in distinct sections and each section includes the main lecture notes (in the same form as will be presented in the lectures) and in addition a collection of exercises/problems, aiming in the understanding and application of the theory. These additional sets of exercises are addressed in the tutorial sessions.</p> <p>The power-point presentations include numerous exercises and problems</p>		

	<p>which students have to complete during the lectures. The tutorial session involves discussions. Collaboration between students is encouraged for the solution of the sets of exercises and problems.</p>
<p>Bibliography</p>	<p><u>(a) Textbooks:</u></p> <ol style="list-style-type: none"> 1. «Γενικά Μαθηματικά», Δ. Γεωργίου, Χ. Γ. Ζαγούρας. Εκδόσεις Νέων Τεχνολογιών, 2019 2. «Στατιστική», Φ. Κολυβά-Μαχαίρα, Ε. Μπόρα-Σέντα, Χ. Μπράτσας. Εκδόσεις: Ζήτη Πελαγία & Σια Ι.Κ.Ε., 3^η Έκδοση, 2018 3. «Medical Statistics, A Commonsense Approach», M.J. Cambell, D. Mashine, J. Wiley & Sons, 4th ed, 2007 4. «Εισαγωγή στη Στατιστική», Α. Κουινιάς, Φ. Κολύβα-Μαχαίρα, Κ. Μπαγιάτης, Ε. Μπόρα-Σέντα, Κ. Χριστοδουλίδη, Θεσσαλονίκη. 2001 5. «Απλές Εφαρμογές των Μαθηματικών στις Επιστήμες της Ζωής και της Υγείας». Γ. Αραχωβίτης. 1998 <p><u>(b) References:</u></p> <ol style="list-style-type: none"> 1. «Γραμμική Άλγεβρα και Εφαρμογές», G. Strang. Ελληνική Έκδοση: Πανεπιστημιακές Εκδόσεις Κρήτης, 2021 2. «Εισαγωγή στη Στατιστική και τις Πιθανότητες», Κ. Ζαφειρόπουλος. Εκδότης: Κριτική, 2017 3. «Μαθηματική Ανάλυση και Εφαρμογές», Β. Ν. Ζαφειρόπουλος. Εκδότης: Πανεπιστήμιο Πατρών, 2012 4. «Ιατρική Στατιστική και Στοιχεία Βιομαθηματικών (Α' Τόμος)», Τ. Παπαϊωάννου, Κ. Φερεντίνος. Εκδότης: Σταμούλης, 2004 5.«Introduction to Algebra & Pharmaceutical Mathematics: An Introductory Course for Students in Nursing, Pharmacy Technology, and Other Health Careers». J. B. Hart, R. R. Barrows, W. Schaller, Kendall Hunt Pub Co; 2nd edition., 2000 6.«Μαθηματική Ανάλυση. Θεωρία και Εφαρμογές». Π.Ι. Νικήτας, Πήγασος-Θεσσαλονίκη, 1997
<p>Assessment</p>	<p>The assessment is performed through written exams. Two midterm exams which take place during the semester examine specific sections of the course syllabus and account for 40% of the total grade of the course:</p> <p>1st Midterm Exam: 30%</p> <p>Assignment (Problem solving): 20%</p> <p>Final Exam: 50%</p> <p>Students are prepared for the final exam through the solution of exercises and problems relevant to the field of pharmacy. The tutorial sessions which take place for one hour every week, involve solving exercises that aid in</p>

	<p>the understanding/comprehending of the course material.</p> <p>The criteria considered for the assessment during the midterm and final exams are the following: (i) understanding of the basic mathematical methods through simple exercises, (ii) application of the theory to the solution of composite problems requiring the methodology of an entire section and (iii) the solution of problems related to the field of pharmacy. The above criteria have weights of 30%, 40% and 30% respectively.</p> <p>The final assessment of the course is structured and covers all the range of the expected learning outcomes.</p>
Language	Greek, English