Mathematics and statistics (Ist YEAR, Ist and IInd SEMESTER)

Credit value (ECTS) 5 + 4

Course category
Domain (Imposed)

Course holder:
Lecturer Ciprian CHIRUȚĂ PhD

Discipline objectives (course and practical works)

Becoming familiar with the main types of issues and approaches in mathematics and applying mathematical concepts in economics and agriculture.

Mathematical modeling of practical problems commonly used in biological and agricultural research and learning the laws of probabilities and optimization techniques.

Acquiring skills for the use of rigorous reasoning and individual study skills;

Forming a systemic point of view on the field and apparatus of Mathematics.

Acquiring the computation skills necessary for the mastering of the mathematical reasoning in using statistic tests;

Understanding the probability theory and linear programming notions using appropriate practical examples;

Applying the given theoretical concepts in order to solve specific problems and modeling processes.

Knowledge of statistical research methods in the field and their application in the profile disciplines.

Acquiring mathematical programming (linear) models.

Contents (syllabus)

Course (chapters/subchapters)
Sem I Elements of abstract algebra
Vector spaces, linear dependence and independence, generators' system, base of a space vector, change of coordinates of a vector when moving from one basis to another, substitution lemma, substitution lemma applications.
Linear transformations, matrix associated to a linear transformations, nucleus and image of a linear transformation, eigenvalues and eigenvectors.
Elements of linear programming
Examples leading to linear programming problems. Graphical method for solving linear programming problems.
The simplex method for solving linear programming problems.
Description of the simplex algorithm; The two-phased method
Probability theory elements
Events. Operations with events. Probabilities. Conditional probabilities. Formulas for calculating probabilities.
Classical probability schemes, discrete and continuous random variables. Operations with random variables. The distribution function of a random variable. Typical values of a random variable. Covariance.

Discrete distributions. Continuous distributions.
Elements of statistics
Organization and describing data. Grouping and graphic representations of the statistical series, Numerical characteristics of statistical series, absolute frequency, relative frequency, cumulative frequencies. Regression, correlation method.
Estimation theory. Estimates point. Estimates by confidence intervals.
Statistical tests.
Sem II Functions of a real variable
Limit and continuity of real functions of a real variable. Continuous functions, limits and continuity, properties of continuous functions on an interval. Points of discontinuity and their classification. Monotone functions.
Differential calculus
Derivatives and differentials of real functions of a real variable. Operations of differentiable functions. Differentiable function composed and inverse functions. Fundamental theorems of differential calculus (Fermat's theorem, Rolle's theorem, theorems average) and their consequences
Characterization using derivative monotony. L'Hospital's rule. Higher order derivability. Convexity characterization using second order derivative sign.
Taylor's formula. Rating points optimally using derivatives. Applications of differential and integral calculus in biology.
Functions of several variables
Function of several variables. Limit and continuity for functions of several variables. Derivatives and differentials of functions of several variables. Extremes of functions of several variables.
Number series. Series of functions
Number series. Series with positive terms. Criteria for convergence of series with positive terms.
Sequences and series of functions. Power series. Development of functions in power series.
Integral calculus
Primitive and integral undefined. Methods of integration: integration by parts formula and formula variable change. Riemann integrability of a function and Riemann integral.
Riemann integrals functions. Properties of integrals functions. Leibniz Newton's formula. The formula of integration by parts and change of variable formula. Improper integrals.
Differential equations
First order differential equations. Differential equations with variables separable. First order differential equations homogeneous. First order linear differential equations.

Practical works
Sem I Matrices and determinants, matrix operations.
Systems of linear equations, the Gauss method, the Gauss Jordan method, the inverse of a matrix.
Independent linear system, dependent linear system, generators' system, basis, change of vector coordinates in the transition from one basis to another.
Linear transformations, matrix associated to a linear transformations, nucleus and image of a linear transformation, eigenvalues and eigenvectors.
Solving linear programming problems by the graphical method

Using the primal simplex algorithm to determine the optimal solution of a linear programming problem,
Solving linear programming problems by the method of two phases. Transportation problems.
Events, operations, probabilities, conditional probabilities, total probability formula, Bayes' formula.
Classical probability schemes (Bernoulli, Poisson, Hypergeometric, generalized)
Random variables. The distribution function of a random variable. Numerical characteristics of random variables: mean, median, modal value, quintiles, simple and centered time, amplitude, dispersion, standard deviation, Pearson coefficient of variation, Fisher asymmetry coefficient, kurtosis and flattening.
Graphical representation of statistical series, absolute frequencies, relative (cumulative)
Regression, correlation method.
Confidence intervals, Student test.
Sem II The derivative of a function of a real variable (review), applications of derivatives.
The derivative of order n, the string of Rolle, the evolution of a function, differentiability and extreme points for functions of a real variable
Derivative-order, second order, mixed derivative of a function of two real variables.
Order differential I and II order for functions of two real variables.
Local extreme points for functions of two real variables, gradient, rotor.
Series of numbers, criteria of convergence of series with positive terms.
Series of numbers, convergence criteria series with some terms.
Series of functions. Decomposition Taylor series, Maclaurin's formula.
Interpolation methods. Lagrange polynomial interpolation, Newton.
The method of least squares
Integral. Calculation methods.
Definite integrals, Applications of integrals, length, area, volume.
Differential equations with variables separable
Homogeneous first order differential equations

Bibliography

1. Aldea Florica, *Matematici aplicate în ştiinţele agricole şi silvice*, Editura Risoprint, Cluj Napoca, 2006.
2. Bunu I. coord. colectiv de autori, *Matematici economice*, Departamentul Editorial Poligrafic al Academiei de Studii Economice a Moldovei, Chişinău, 2012.
3. Burdujan I., *Elemente de algebră cu aplicaţii în biologie*, Ed. Pim, Iaşi, 2006.
4. Diaconiţa V., Spînu M., Rusu Ghe., *Matematici aplicate în economie*, Ed. Sedcom Libris, Iaşi, 2004.
5. Jaba Elisabeta, *Statistică* - ediţia a doua - Editura Economică, Bucureşti, 2000.
6. Jaba Elisabeta, *Statistică descriptivă - manual pentru învăţământ deschis la distanţă*, Ed. Univ. Al. I. Cuza, Iaşi, 2005.
7. Jaba Elisabeta, Pintilescu Carmen, *Statistică - teste grilă şi probleme*, ediţia a doua, Ed. SedcomLibris, Iaşi, 2007.
8. Diaconiţa V., Spînu M., Rusu Ghe., *Matematici aplicate în economie - Teste grilă*, Ed. Sedcom Libris, Iaşi, 2004.
11. Burtea M., Burtea Georgeta, *Matematică, clasa a X-a*, Ed. Carminis, Piteşti, 2005.

12. Chiruţă C., *Elemente de matematică. Algebră liniară şi statistică matematică,* Editura „Ion Ionescu de la Brad" Iasi, 2019.

Evaluation

Evaluation form	Evaluation Methods	Percentage of the final grade
Exam	Oral and written examination	10%+60%
Appreciation of the activity during the semester	Oral assessment during the semester and written verification test.	30%

Contact
Lecturer Ciprian CHIRUŢĂ PhD.
Facultatea de Horticulture - USAMV Iaşi
Aleea Mihail Sadoveanu nr. 3, Iaşi, 700490, România
telefon: 0040 232 407 437,
E-mail: kyru@uaiasi.ro