COURSE DESCRIPTION

Course code	Volume in ECTS credits	Institution	Faculty	Department
AGR8001	8	VDU, ŽŪA	Agronomy	Institute of Agroecosystems and Soil Science

Course title in Lithuanian

Agronominių tyrimų planavimas ir analizė

Course title in English

Research Methodology in Agronomy

Study methods	Volume in ECTS credits
Lectures	2
Consultations	1
Practicums	1
Individual work	4

Short course annotation in Lithuanian (up to 500 characters)

Dalykas skirtas pirmųjų metų doktorantams. Dalyko tikslas - suteikti doktorantams agronominio mokslinio tyrimo savarankiško planavimo, atlikimo, duomenų statistinės analizės, rezultatų vertinimo ir interpretavimo žinių ir ugdyti gebėjimus, reikalingus rengiant daktaro disertaciją ir toliau savarankiškai dirbant mokslinį darbą. Dalyko studijų formos: paskaitos, pratybos, konsultacijos, pasirengimas kontroliniam darbui, individualiosios užduoties atlikimas, pasirengimas egzaminui.

Short course annotation in English (up to 500 characters)

The subject is delivered for the first year PhD students. The aim of the course is to provide PhD students with knowledge and abilities of autonomous agronomic research planning, statistical evaluation and interpretation of the research results. These knowledge and abilities are important in doing research and writing PhD degree theses and in future autonomous research work. The studies of the subject include lectures, practicums, consultations, preparation for intermediate test, completion of individual assignment, preparation for examination.

Relevance of the course

The course helps for PhD students to plan, conduct investigation, make statistical analyses of research data, compile conclusions, write PhD theses and publications.

Course aims

1. To develop knowledge and their application:
   - Theoretical and practical aspects of the general and specific agronomic research methods;
   - Theoretical and practical aspects of the experimental design, conducting of the experiments and experimental statistics;
   - Recommendations and requirements for writing scientific articles and doctoral theses.
2. To develop research abilities:
   - To formulate research problem, title, hypothesis, goal and objectives, choose the appropriate agronomic research methods;
   - To plan one and several factors experiments, to choose proper statistical methods for the analysis of the experimental data;
   - To develop research methodology, to choose and present statistical indicators in the scientific publications;
   - To prepare the data for statistical analysis, to choose computer programs for statistical data analyses according to the experiment design;
   - To formulate conclusions, consistent with the experimental data and the results of statistical analysis.
3. To develop social abilities:
   - To communicate with colleagues, the scientific community and the public providing innovative information in the field of research.

4. To develop personal abilities:
   - To design own future learning perspective, to take responsibility, critically to evaluate his own strategic solutions;
   - To develop creative intellectual personal competences.

Content (topics) and methods

Lectures

1. Introduction. Science and its role, unity of research planning and statistical analysis.
2. Agronomic Research Methods: advantages and disadvantages.
3. Research process and it's planning.
4. The scientific information sources and search possibilities.
5. Experiment planning: theoretical and practical aspects.
6. Planning and conducting of field experiment.
7. Specifics methods of agronomic research.
8. Data preparation for statistical analysis.
9. Population and sample: concepts and statistical indicators.
10. Statistical distributions and their application in experimental statistics.
11. Data grouping, population parameters and sampling statistics.
12. Mean and other measures of central tendency.
13. Testing of null hypothesis.
14. Assumptions of ANOVA and regression analysis.
15. The research data transformation.
16. ANOVA application for the assessment of agronomic research data.
17 Regression and correlation analysis application for the assessment of agronomic research data.
18. Presentation of statistical analysis results in the scientific publications.
19. Writing of research publications and theses.

Practicums

1. Sample statistical indicators, confident interval and *t* test.
2. Assumptions of statistical analysis and data transformation.
3. Single and multi-factor ANOVA.
4. Regression and correlation analysis.

Methods of learning

Lecture material is visualized using multimedia and blackboard. Students are involved in the debate, either individually or by groups. Groups are also given the task under the studied material, they prepare and present the tasks performed. After each presentation the discussion is organized. Each doctoral student gets individual task: to choose and describe research methods according to the dissertation topic. Students review each other's research methodologies developed. During the practicums the tasks are given using real research data. Doctoral students carry out tasks independently using software packages and in consultation with the teacher in the computer room. Doctoral students have to formulate conclusions drawn from the results of tasks performed. They present the results of practicums using computer programs. Doctoral students are additionally consulted in accordance with the agreed schedule and by IT means. In the absence of a minimum number of doctoral students the subject studies are organized through consultation.

Structure of cumulative score and value of its constituent parts

Types of students' independent work	*Weight score*	*Deadlines of assessment*
Intermediate test	0.15	8th week
Practicums	0.10	11-15th week
Individual assignment (project)	0.15	10th week
Exam	0.60	17-20th week

Compulsory reference materials

No.	Authors of publication, title, publishing house, year of publication.
1.	Hoshmand A. R. Design of experiments for agriculture and the natural sciences. – Chapman & Hall/CRC, USA, 2006
2.	Kardelis K. Mokslinių tyrimų metodologija ir metodai (penktasis leidimas), 2016
3.	Mokslinės metodikos inovatyviems žemės ir miškų mokslų tyrimams. Kaunas, Latutė, 2013
4.	Palaniswamy U. R., Palaniswamy K. M. Handbook of statistics for teaching and research in plant and crop science, USA, The Haworth Press, Inc., 2006
5.	Raudonius S. Mokslinių tyrimų planavimas ir analizė. – Akademija, 2008
6.	Rowena M. How to write a theses.-Great Britain, Open University Press, 2003
7.	Welham S. J., Gezan S. A., Clarks. J., Mead A. Statistical Methods in Biology: Design and analysis of Experiments and Regressions, CRC Press, 2015.
8.	Wu J. and Hamada M. S. Experiments: planning, analysis, and optimization. Wiley Series in Probability and Statistics, 2009

Supplementary reference materials

No.	Authors of publication, title, publishing house, year of publication.
1.	Box G. E. P., Hunter J. S., Hunter W. G. Statistics for experimenters: design, discovery, and inovation. John Wiley & Sons, USA, 2005
2.	Clewer Alan G., Scarisbrick David H. Practical statistics and experimental design for plant and crop science. – England, John Wiley and Sons, LTD, 2001
3.	Čekanavičius V., Murauskas G. Statistika ir jos taikymai I. – V., TEV, 2001
4.	Čekanavičius V., Murauskas G. Statistika ir jos taikymai II. – V., TEV, 2002
5.	Onofri A., Carbonell E. A., Piepho H-P., Mortimer A. M., Cousens R. D. Curent statistical issues in weed research. Weed Research, 2010, v. 50, No 1, p. 5-24
6.	Heath D. An Introduction to experimental design and statistics for biology. – Great Britain, UCL Press Ltd.,1988
7.	Larry B. Christensen. Experimental methodology. – USA, Allyn and Bacon, 1997
8.	Mann P. S. Introductory statistics. – John Wiley & Sons, Inc, USA, 2007
9.	Mead R., Curnow R.N. and Hasted A.M. Statistical methods in agriculture and experimental biology. Great Britain: T.J. Press Ltd., 1993
10.	Hoshmand A. Reza. Experimental research design and analysis: a practical approach for agricultural and natural sciences. – USA, CRC Press, 1994
11.	Mann P. S. Introductory statistics. John Wiley & Sons, Inc, USA, 2007
12.	Sokal Robert R. and Rohelf F. Biometry: the principles and practice of statistics in biological research. –New York: W.H. Freeman and Company, 1995
13.	Raudonius, Steponas. Application of statistics in plant and crop research: important issues // Žemdirbystė = Agriculture / Lietuvos agrarinių ir miškų mokslų centras, Aleksandro Stulginskio universitetas. Akademija, T. 104, Nr. 4 (2017), p. 377-382.
14.	Tarakanovas P., Raudonius S. Agronominių tyrimų duomenų statistinė analizė taikant kompiuterines programas ANOVA, STAT, SPLIT-PLOT iš paketo SELEKCIJA ir IRSTAT. – Akademija, 2003
15.	Velička R., Raudonius S., Marcinkevičienė A., Trečiokas K. Lauko bandymų planavimas ir atlikimas. Metodinė priemonė. – Akademija, 2004

Course programme designed by

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