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| **Title and code** of the subject: **Research methodology - scientific communication, MTMKG7015A** | **ECTS Credit Points: 5** |
| **Type** of the subject: compulsory | |
| **Ratio of theory and practice:** (credit%) **40/60** | |
| **Type and number of classes per semester**: 28 hours lecture and 42 hours practice per **semester**  Number of teaching hours / week : 2+3 (lecture and practice) | |
| **Type of exam**: exam | |
| **Subject in the curriculum:** semester 3 | |
| Preliminary requirements:- | |
| **Summary of content - theory**: | |
| Course objectives:  Fulfilling the course, students will be able to formulate problems at the level of R+D, will be capable of determining potential scientific alternatives for their solutions and working out proper research plans. The students will know and will be able to plan the proper conditions required for efficient research. As part of the course, statistical data analyses as methods will be learned and applied in specific case studies. Environmental statistics is incorporated into research planning and input and output data assessment. In addition, students will be familiar with the written communication forms of new scientific results and conclusions to different target groups, and they will be abile to develop this skill via selected types of writings of scientific articles under guidance and continuous share of opinions and scientific argument. Practical tasks serve to apply the theoretical knowledge on research methodology, ideally, based on the subject of the BSc thesis, which are required to formulate potential approaches at the level R&D&I and develop scientific directions of research. To improve the written communication skills on scientific work and results, students will write an original article, a review and a short study for the public on any agro-environmental issues.  Contents:   1. Evolution of science, science classification 2. Types and characteristics of scientific research (basic, applied; qualitative, quantitative; descriptive, analytical) 3. Research methodologies (empirical, theoretical; logical, comparative) 4. Process and steps of scientific research, terms of efficient, high-quality research 5. Data and information sources, literature review techniques 6. Problem formulation, hypothesis, objectives, evaluation methods 7. Mathematical methods, research designing 8. Modelling, scientific model types and applications 9. Sampling strategies, statistical bases of environmental sampling 10. Cumulative and probability distribution functions, one sample and two sample t-tests, paired difference test, variance analysis, nonparametric tests 11. Relationships in the environment: correlation, regression 12. Data and information visualization techniques 13. Communication tools for scientific results and conclusions, structures of scientific articles (original article, review, short study for the public) 14. Measures of scientific performance, ethical issues in science | |
| **Summary of content - practice**: | |
| Skills to be gained:  Students will practice the implementation of principles, and application of procedures as well as interpretation methods adapted to a selected case study, individually, understanding the approach of agriculture related environmental issues at scientific level, following the instructions of the lecturer. Students will work on either improving their BSc theses or planning their MSc research projects and write reports and articles for different target groups about the same scientific issue. The overall aim is to make it understandable what added value to the actual level of scientific knowledge means and how a research plan makes research successful.  Contents:   1. Making difference between research and engineering; discovering rules in science; finding patents and understanding the link between science and business sector. 2. Formulating a scientific problem that has not been solved, yet, based on the articles available via the Science Direct data base, based on the student’s interest. 3. Formulating a hypothesis to justify a theory, and a relevant objective; justifying the approach. 4. Literature review and writing an Introduction chapter for an original research paper manuscript; creating the structure of a review. 5. Developing a research proposal with consideration of all necessary resources; clarifying expectations based on the actual level of scientific knowledge, creating conceptual model. 6. Describing and assessing a case study, working with data, transforming data into information, modelling and model validation. 7. Identifying relevant indicators of a phenomenon, relationships; formulating experimental designs; data collection, sampling from existing databases, measurements in the field and in the laboratory with environmental samples. 8. Finding and discussing changes, trends; applying relevant statistical methods; understanding correlation and regression. 9. Answering the scientific question, solving the problem, arriving at a conclusion that is an added value to the actual level of knowledge. 10. Analysing the structure of an abstract and writing one. 11. Finalizing the research paper manuscript. 12. Writing short article for the public based on the original research paper. 13. Preparing a 10 minutes long presentation for scientists. 14. Analysing reviewers’ assessment and opinions for given manuscripts submitted to a journal. | |
| **Literature, handbooks in English** | |
| 1. Macrina, F. L. (2000): Scientific Integrity: An Introductory Text with Cases, 2nd ed. ASM Press, Washington, DC.ISBN-13: 9781555811525 2. Montgomery, S. L. (2003): The Chicago Guide to Communicating Science. University of Chicago Press, Chicago. ISBN-13: 978-0226534855 3. J. L. Lebrun (2008): Scientific writing. A readers and writer’s guide. Word Scientific Publishing. Singapore. 223.p. ISBN-13: 978-9814350600 4. M.J. Katz (2009): From research to Manuscript. A guide to scientific writing. Spinger Publ. 204. p.  ISBN-13: 978-1402094668 5. [Mertler, Craig A.](http://www.prospero.hu/katalogus/kereso/?form_submit=1&szerzo=Mertler+Craig) (2015): Introduction to Educational Research. Sage Publications. ISBN-13: 9781483375489 6. Exercise book: Practical exercises for the course of Environmental statistics, research methodology - scientific communication | |
| **Competencies gained** | |
| 1. **Knowledge:**  * Understand and use professional language in the field of agro-environmental issues both in written and oral, and both in presentation and argument; * Familiar with research methodologies and techniques as well as research planning and designing in the field of agro-environmental issues;  1. **Skills:**  * Able to identify scientific challenges, issues, problems and to recommend potential solutions in an innovative way;  1. **Attitude:**  * Become committed to objective approach of science  1. **Autonomy and responsibility:**  * Able to complete as well as to manage a research project in group. | |
| **Responsible lecturer: Elza Kovács, PhD, associate professor** | |
| **Terms of course completion:** | |
| 1. Completing assignments / exercises listed in Exercise book: Practical exercises for the course of Environmental statistics, research methodology - scientific communication 2. Being active in group works 3. Being active in class works | |
| **Form of examination:** | |
| Essay type written exam is taken in the examination period of the semester focusing on the knowledge gained. List of the subjects is provided below. | |
| **Requirement(s) to get signature:** | |
| Submitting reports in due time, taking part actively in the practices and completing home work individually are compulsory. Student may skip class maximum 3 times during the semester. | |
| **Exam questions:** | |
| 1. Introduce the evolution of science and clarify the difference between scientific and engineering activities! 2. Introduce information sources for up-to-date knowledge in science and in engineering! 3. Introduce the empirical, theoretical; logical and comparative research methodologies! 4. Interpret the process and steps of scientific research and summarize the terms of efficient, high-quality research! 5. Introduce the role of modelling in qualitative research and give examples in the field of agriculture related environmental issues! 6. Explain what the terms aim, objective, hypothesis, research methodology mean! 7. What are the contents of a research plan and how it is built up? 8. Introduce the ways of data collection, principles of sampling strategies, methods of data processing and the interpretation techniques in the field of agriculture related environmental issues! 9. Introduce the structure of an original research paper! 10. Introduce the structure of a scientific review! 11. Introduce the structure of a short scientific article for the public! 12. Introduce the structure of a short oral presentation given for scientists! 13. Introduce the measures of scientific performance (impact factor, h index)! 14. What ethical issues should be considered when research is planned? 15. What ethical issues should be considered when results are about to be communicated/published? | |