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| <b>Study programme(s): Applied Mathematics (MAP)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                     |
| <b>Course title: SAMPLING AND EXPERIMENTAL DESIGN (P505)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                    |                     |
| <b>Lecturer(s): Sanja Konjik</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                    |                     |
| <b>Course status: compulsory on module: Data Analytics and Statistics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                     |
| <b>ECTS points: 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                     |
| <b>Requirements:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                    |                     |
| <b>Learning Objectives</b><br>The aim of the course is to make students familiar with sampling theories and the importance of proper sampling as well as with a proper design of the experiment for later statistical analysis.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                     |
| <b>Learning Outcomes</b><br>Students will be able to correctly design the experiment setting and decide how to perform proper sampling methods depending on the statistical analysis to be used. Students will be able to apply different sampling theories in real-world situations and evaluate the quality of the sample in their research.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                    |                     |
| <b>Syllabus</b><br><i>Theoretical instructions</i><br>Data collection methods, EUROSTAT methodology. Major steps in sampling planning. Simple random sampling. Systematic random sampling, stratified random sampling and post-stratification. Clusters and multi-step sampling plans. Sampling of unreliable populations, nonprobability sampling (convenience sampling, purposive sampling, quota sampling, <i>snowball</i> sampling). Repeated sampling: <i>bootstrap</i> and <i>jackknife</i> methods. Survey sampling methods.<br>Introduction to experiments in industry: strategy, planning. The basic principles of a well-designed experiment: randomization, replication, block division, factorial experiments. Simple comparative experiments, one-factor experiments, multi-factor experiments, random factor experiments. Experimental validity.<br><br><i>Practical instructions</i><br>Practical instructions follow the content of the theoretical instructions, implementation of the presented methods through exercises and examples. |                    |                     |
| <b>Literature</b> <ol style="list-style-type: none"> <li>1. Roxy Peck, Chris Olsen, Jay L. Devore, <b>Introduction to Statistics and Data Analysis</b>, Cengage Learning, 2015.</li> <li>2. Carl-Eri Sarndal, Bengt Swensson, Jan Wretman: <b>Model Assisted Survey Sampling</b>, Springer series in statistics, 2003.</li> <li>3. Lohr, S. L., <b>Sampling Design and Analysis</b>, Duxbury Press, 1999.</li> <li>4. Montgomery, D.C., <b>Design and Analysis of Experiments</b>, Fifth Edition, John Wiley &amp; Sons, INC., 2001.</li> <li>5. Cox, D. and Read, N., <b>The theory of the design of experiments</b>, Chapman and Hall, 2000.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                 |                    |                     |
| <b>Number of active classes</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Lectures: 2</b> | <b>Exercises: 1</b> |
| <b>Teaching methods</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                    |                     |

Interactive lectures, drafting of experiment plans in groups, individual work, example analysis and applications of selected examples, report writing on performed statistical analyses and presentation of results, discussions.

**Grading (maximum number of points 100)**

| <b>Pre-exam obligations</b> | Points    | <b>Final exam</b> | Points    |
|-----------------------------|-----------|-------------------|-----------|
| seminar work                | <b>70</b> | oral exam         | <b>30</b> |