Subject name	Experimental design for the forest research	
Subject code		
Department	Department of Biometry and Forest Productivity Institute of Forest Resources Management	
Faculty	Faculty of Forestry	
Subject supervisor/Lecturer	Jarosław Socha, Ph.D. Professor at Department of Biometry and Forest Productivity rlsocha@cyf-kr.edu.pl Phone: +48 126625011, Personal webpage; Google Scholar Profile;	
General information	Teaching period	Summer semester
	ECTS credit	2
	Lectures total	14
	Classes	16
Objective and general description	This is a basic course in designing experiments and analyzing the resulting data. The course objective is to learn how to plan, design and conduct experiments efficiently and effectively, and analyze the resulting data to obtain objective conclusions. Both design and statistical analysis issues are discussed. The class will focus on enabling you to have a fully designed experiment, which you can then carry out as a master thesis, research paper, or dissertation proposal.	
Lectures **7 × 2 hours**	1. General rules of experimental design: formulating hypothesis, defining research problem, sample selection, data collection, statistical test selection and verification of hypothesis, importance of significance level. 2. Representative method. Sampling designs. Selection of sample size, sample size in dependence on precision or cost. Planning and schemes of experiment (randomized controlled trial, randomized block design, Latin squares). 3. Importance of variables distributions in research experiment. Probability distributions of continuous and discrete variables. Goodness-of-fit testing. Normality testing. Variable transformations. 4. Methods for two populations. Parametric tests for comparison of two populations, t – Student test for dependent variables and independent variables. Nonparametric tests: U – Mann-Whitney and Wald-Wolfowitz test, Wilcoxon signed rank test. Methods concerning a few populations. One-way Analysis of Variance. Test for variance homogeneity. Post-hoc tests. Nonparametric ANOVA– Kruskal-Wallis test. Multiple comparison of mean rank. Two-way ANOVA. 5. Correlation and regression analysis. Development of regression model. Simple linear regression and multiple regression. Assumption of regression analysis: normality of residuals, linearity, homoscedasticity, autocorrelation, collinearity). Linearized multiple regression. Nonlinear regression analysis. Regression diagnostics. Practical use of regression models in forest research. 6. Presentation of results. Presentation of analyses. Writing dissertations and scientific research articles. 7. Final test.	

Classes 8 × 2 hours	1. The use of statistical software, data management, displaying summaries of data, graphs. Case selection. Running basic statistical analysis, description statistics, charts. 2. Description of variable dispersion. Estimation of sample size. Goodness-of-fit and normality distribution testing (Kolmogorov-Smirnov, $\chi 2$, and Shapiro-Wilk tests) 3. Parametric tests for two populations and its assumptions. Parametric tests for comparison of two populations, t – Student test for dependent variables and independent variables. Nonparametric tests: U – Mann-Whitney and Wald-Wolfowitz test, Wilcoxon signed rank test. Interpretation of test results. 4. One-way ANOVA. Testing of ANOVA assumptions: normality, Levene's test for homogeneity of variances. Post-hoc tests and its selection. Nonparametric ANOVA– Kruskal-Wallis test. Multiple comparison of mean rank. Interpretation and presentation of ANOVA results . 5. Analysis of variable dependences. Correlation and regression. Linear correlation Pearson's coefficient and assumptions of its use (residua analysis). Non-parametric correlation (R Spearmann rank correlation coefficient, Kendall tau rank correlation, gamma rank correlation). Linear regression analysis. 6. Multiple and complex regression. Multiple linear regression analysis. Assumptions of multiple regression (collinearity, linearity, residual distributions, autocorrelation). Discrete variables in regression analysis. Practical use of dummy variables and interactions. 7. Linearized multiple regression. Nonlinear regression. Regression models diagnostics. 8. Demonstration of ability for practical problem solving.
Literature	Quinn, G., Keough, M. 2002. Experimental Design and Data Analysis for Biologists. Cambridge University Press. Mehtätalo, L. 2010. Forest Biometrics with examples in R. University of Eastern Finland. School of Forest Sciences. Toutenburg, H. 1995. Experimental Design and Model Choice. The Planning and Analysis of Experiments with Continuous or Categorical Response. Springer-Verlag Berlin Heidelberg GmbH
Assessment method	Classes – demonstration of ability for practical problem solving, lectures – test.