Course: Quantitative Methods					**Status:** optional			
Semester	No. of weeks	No. of hours (weekly)			No. of hours (total)			ECTS
		Lect.	Class	Lab.	Lect.	Class	Lab.	
autumn		2		2	15		15	4
Lecturer: Grzegorz Bulczak, PhD								

Contents of study:

1. Data-Driven Decision Making: Emphasize the crucial role of quantitative methods in making informed decisions across various fields, moving beyond intuition to evidence-based insights.
2. Quantitative Foundations: Revisit core statistical concepts (e.g., probability, distributions, hypothesis testing) with a strong focus on their practical application and interpretation in real-world data.
3. Introduction to Programming for Data: Integrate an accessible introduction to a relevant programming language (e.g., Gretl, Stata or R) for data manipulation, analysis, and visualization, treating it as a fundamental tool.
4. Regression Analysis (Beyond Linearity): Cover linear regression thoroughly, but then extend to more advanced topics like multiple regression, logistic regression, and an introduction to non-linear models.
5. Time Series Analysis & Forecasting: Introduce techniques for analyzing time-dependent data, including ARIMA models, exponential smoothing, and machine learning approaches for forecasting.
6. Optimization & Simulation: Explore concepts of mathematical optimization (e.g., linear programming) and simulation (e.g., Monte Carlo) to model complex systems and find optimal solutions.
7. Machine Learning Fundamentals, AI (Applied): Dedicate a segment to the basics of supervised and unsupervised machine learning algorithms (e.g., k-NN, decision trees, clustering) and their application in quantitative analysis.
8. Data Visualization & Storytelling: Stress the importance of effectively communicating quantitative findings through compelling and accurate data visualizations, teaching principles of good design.
9. Big Data, Data Management & Cloud Computing.
10. Ethical Considerations & Responsible AI: Integrate discussions on the ethical implications of using quantitative methods, including data privacy, bias in algorithms, and the responsible deployment of AI-driven solutions.

Criteria for assessment: Project developed during the practical (lab.) part of the course (10 points). Volountary presentation (2 points) The course is passed after receiving 6 points.

References:

1. **Gelman, A., Hill, J., & Vehtari, A. (2020).** ***Regression and Other Stories*****. Cambridge University Press.**
2. **Hyndman, R. J., & Athanasopoulos, G. (2021).** ***Forecasting: Principles and Practice*** **(3rd ed.). OTexts.**
3. **James, G., Witten, D., Hastie, T., & Tibshirani, R. (2023).** ***An Introduction to Statistical Learning: With Applications in R*** **(2nd ed.). Springer. OR James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J. (2023).** ***An Introduction to Statistical Learning: With Applications in Python*****. Springer.** [Choose the appropriate version based on the course's language focus.]
4. **McKinney, W. (2017).** ***Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*** **(2nd ed.). O'Reilly Media.**
5. **Provost, F., & Fawcett, T. (2013).** ***Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking*****. O'Reilly Media.**