DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21310/22	**Title of course:** Applied Macroeconometrics

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 5

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
projects for the final exam 40%
final exam 40%

Student workload:
student workload: 130 h, participation in lectures 26 h, participation in seminars 26 h, elaboration of a semester project 49 h, preparation for the final exam 29 h

Teaching results:
Upon successful completion of this course, students will have knowledge of advanced methods of econometric approach to the analysis and modeling of macroeconomic phenomena and should be able to use basic Bayesian econometric techniques.
Students will gain practical skills and competencies with the application of advanced econometric methods in the analysis of macroeconomic problems using software R and Python.

Indicative content:
1. Introduction to Bayesian analysis, basic concepts, prior, likelihood, posterior.
2. Markov chains Monte Carlo (MCMC), Metropolis algorithm, Gibbs sampler.
3. Bayesian estimation and analysis of a simple econometric model.
4. Models of Bayesian econometrics.
5. Bayesian estimation of VAR models.
6. Bayesian estimation of RBC/DSGE models.
7. Introduction to discrete dynamic models.
8. Dynamic stochastic dynamic economic processes.
9. Models in linear state space.
10. Introduction to Kalman filter.
11. Introduction to dynamic programming.
12. Chosen economic applications (growth models, search models).
13. Chosen economic applications (business cycle models).

Support literature:
1. Bårdsen, G., Eitrheim, Ø., Jansen, E.S., Nymoen, R.: The Econometrics of Macroeconomic Modelling, Oxford, 2005

2. Chan, J., Koop, G., Poirier, D., Tobias, J.: Bayesian Econometric Methods, Cambridge University Press, 2019
3. Canova, F.: Methods for Applied Macroeconomic Research, Princeton University Press, 2007
4. DeJong, D.N., Dave, C.: Structural Macroeconometrics. Princeton University Press, 2011
5. Geweke, J.: Contemporary Bayesian Econometrics and Statistics, Wiley-Interscience, 2005
6. Ljungqvist, L., Sargent, T.J.: Recursive Macroeconomic Theory. 4. vydanie. MIT Press, 2018
7. Lukáčik, M., Lukáčiková, A., Szomolányi, K.: Bayesovská ekonometria. Letra Interactive, 2017
8. Sargent, T.J., Stachurski, J.: Quantitative Economics in Discrete and Continous Time. quantecon.org, 2020
9. Stachurski, J.: Economic Dynamics: Theory and Computation. MIT Press, 2009

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 0

A	B	C	D	E	FX
0.0	0.0	0.0	0.0	0.0	0.0

Lecturer: doc. Ing. Karol Szomolányi, PhD., prof. Ing. Martin Lukáčik, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21320/22	**Title of course:** Applied Microeconometrics

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study:

Degree of study: II.

Prerequisites:

Requirements to complete the course:
individual work and continuous tests 20%
project for the final exam 40%
final exam 40%

Student workload:
student workload: 156 h, participation in lectures 26 h, participation in seminars 26 h, elaboration of a semester project 62 h, preparation for the final exam 42 h

Teaching results:
Upon successful completion of this course, students will have knowledge of methods and applications of microeconometric approach to the analysis and modeling of economic phenomena and processes and should be able to use econometric techniques and procedures for different types of data.
Students will gain practical skills and competencies with the applications of microeconometric methods in the analysis of economic problems using software R and Python.

Indicative content:
1. Applications of Dummy Variables Models
2. Applications of Panel Data Models
3. Applications of Dynamic Panel Data Models
4. Applications of Nonlinear Effects Models
5. Applications of Panel Data Models for Binary Choice
6. Applications of Ordered Choices
7. Applications of Models for Count Data
8. Applications of Multinomial Logit
9. Applications of Tobit and Selection Models
10. Applications of Latent Class Models
11. Applications of Mixed Logit
12. Stated Preference Data, Applications of Hybrid Choice Models
13. Applications of Discrete Choice Models

Support literature:

1. Adams, C.P.: Learning Microeconometrics with R, Chapman & Hall CRC Press, 2021.
2. Croissant, Y., Millo, G.: Panel Data Econometrics with R, John Wiley & Sons, 2019.
3. Cameron, A.C., Trivedi, P.K.: Microeconometrics: Methods and Applications, Cambridge University Press, 2005.
4. Wooldridge, J.: Econometric Analysis of Cross Section and Panel Data, MIT Press, 2010.
5. Greene, W.H., Hensher, D.: Modeling Ordered Choices, Cambridge University Press, 2010.
6. Pesaran, M.H.: Time Series and Panel Data Econometrics. Oxford University Press, 2015.

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 105

A	B	C	D	E	FX
54.29	25.71	16.19	2.86	0.95	0.0

Lecturer: Ing. Adriana Lukáčiková, PhD., prof. Ing. Martin Lukáčik, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KŠ FHI/IID22300/21	**Title of course:** Categorial Data Analysis

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 5

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
Seminars (40%):
Assignment (20 %)
Written essay (20 %)
60% final paper (20 % theoretical part, 40% practical – examples solution)

Student workload:
Total study load (in hours): 130 hours
Distribution of study load
Lectures participation: 26 hours,
Seminar participation: 26 hours,
Preparation for seminars: 13 hours,
Written assignment: 13 hours,
Seminar essay preparation: 22 hours,
Final exam preparation: 30 hours

Teaching results:
Successful completion of the course is a guarantee that students will gain a basic overview of the statistical methods for categorical data analysis in practice. Students will acquire the following:
abilities:
- knowledge of basic concepts, principles, methods and procedures used in categorical data analysis
- knowledge of analyses of the relationship between two variables
- knowledge of exact tests
skills:
Emphasis is placed on the application of the methods and the interpretation of results by applying the techniques to a variety of data sets.
competencies:
Students will apply knowledge especially in the socio-economic analysis and marketing.

Indicative content:
Topics of this course include descriptive analysis of categorical data, analysis of contingency table data, tests for independence, comparing proportions, exact methods, and treatment of ordered data, statistical methods for analysing data where the outcome variable is categorical or discrete. The course will emphasize the theoretical underpinnings of the methods as well as an applied

understanding of the computation and interpretation, both of which are necessary to succeed with real data analysis.

Support literature:

1. ŘEZANKOVÁ, H. Analýza kategoriálnych dat. Praha: VŠE, 2005. ISBN 80-245-0926-1
2. RUBLÍKOVÁ, E. – LABUDOVÁ, V. – SANDTNEROVÁ, S. Analýza kategoriálnych údajov. Bratislava: EKONÓM, 2009.
3. ŘEZANKOVÁ, H. Analýza dat z dotazníkových šetření. Praha: Professional Publishing, 2010.
4. PECÁKOVÁ, I. Statistika v terénních průzkumech. Praha: Professional Publishing, 2011.
5. AGRESTI, A. An Introduction to Categorial Data Analysis. John and Wiley, 2019.
6. POWERS, D.A. Statistical Methods for Categorical Data Analysis. Emerald Publishing Limited, 2008.

Syllabus:

1. Classification of categorical variables, scales of measurement, data coding.
2. Questionnaire survey. Scales of Measurement.
3. Frequency distribution and descriptive statistics.
4. Bernoulli and Binomial probability distribution.
5. Estimates of parameter π.
6. Tests of hypotheses concerning frequencies.
7. Contingency table. Tests of independency of two variables in the contingency tables.
8. Symmetric and asymmetric measures of contingency.
9. Association table. Tests of independency of two dichotomous variables (chi-square goodness-of-fit test, exact test).
10. Generalized Linear Model for binary data. Logistic Regression model.
11. Inference for logistic regression
12. Multiple logistic regression
13. Summary of the lectured subject matter

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 21

A	B	C	D	E	FX
47.62	38.1	14.29	0.0	0.0	0.0

Lecturer: doc. RNDr. Viera Labudová, PhD.

Date of the latest change: 07.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KŠ FHI/IID22340/21	**Title of course:** Data Mining
Type, load and method of teaching activities: **Form of course:** Lecture / Practical **Recommended load of course (number of lessons):** **Per week:** 2 / 2 **Per course:** 26 / 26 **Method of study:** present	
Number of credits: 6	
Recommended semester/trimester of study: 3.	
Degree of study: II.	
Prerequisites:	
Requirements to complete the course: Seminars (40%): − Assignment (20 %) − Seminar work (20 %) Final exam (60%): − Theoretical part (20 %) − Practical part (40 %)	
Student workload: Total study load (in hours): 156 hours Lectures participation: 26 hours, Seminar participation: 26 hours, Preparation for seminars: 26 hours, Written assignment: 26 hours, Seminar work preparation: 22 hours, Final exam preparation: 30 hours	
Teaching results: Successful completion of the course is a guarantee that students will gain a basic overview of the data mining process in practice. Students acquire the following: abilities − knowledge of basic concepts, principles, methods and procedures used in data mining, − knowledge of individual stages of the process of extracting information from databases, − knowledge of theoretical principles of data mining models. − skills − Students will be able to implement individual steps of the process of extracting information from databases using professional software SAS Enterprise Miner. − Students will learn to adequately apply the methods and procedures of data mining and interpret the results. competencies − Students will be able to apply the acquired knowledge and skills in solving data mining problems in practice.	
Indicative content:	

The data mining process provides a framework to extract nontrivial information from data. With the advent of massive storage, increased data collection, and advanced computing paradigms, the data at our disposal are only increasing. To extract knowledge from these massive data assets, we need to employ advanced approaches like data mining algorithms, in addition to simple statistical processing. Studying of subject enables to understand sense and possibilities of data mining.

Support literature:

1. TEREK, M., HORNÍKOVÁ, A., LABUDOVÁ, V. Hĺbková analýza údajov. Bratislava: Iura Edition, 2010. ISBN 978-80-8078-336-5
2. BERKA, P. Dobývání znalostí z databází. Praha: Academia, 2003. ISBN 80-200-1062-9
3. PETR, P. Data Mining: Díl I. Pardubice: Univerzita Pardubice, 2008, 139 s. ISBN 978-80-7395-098-9
4. SKALSKÁ, H. Data mining a klasifikační modely. Hradec Králové: Gaudeamus, 2010. ISBN 978-80-7435-088-7
5. LABUDOVÁ, V. Hĺbková analýza údajov s programom SAS Enterprise Miner (praktikum). Bratislava: Ekonóm, 2012. ISBN 978-80-225-3402-4
6. LABUDOVÁ, V. Rozhodovacie stromy ako prediktívna modelovacia technika. Slovenská štatistika a demografia: vedecký časopis. Roč. 27, č. 3 (2017), s. 60-76. Bratislava: Štatistický úrad Slovenskej republiky. ISSN 1210-1095
7. KANTARDZIC, M. Data Mining. Concepts, Models, Methods and Algorithms. USA, J. Wiley and Sons, 2003. ISBN 0-471-22852-4
8. GUIDICI, P. Applied Data Mining. New York, J. Wiley and Sons, 2004. ISBN 0-470-84679-8
9. LAROSE, D. T. Discovering Knowledge in Data. An Introduction to Data Mining. USA: Wiley 2005. ISBN 978-0-471-66657-8
10. LAROSE, D. T. Data Mining. Methods and Models. USA: Wiley 2006. ISBN 0-471-66656-4

Syllabus:

1. Knowledge discovery in databases, Data mining. The Data mining process.
2. Data mining – objectives and tasks. Big data and data mining. Data mining and application areas.
3. Data mining methodology. Data mining tools.
4. Databases. Data preparation (data cleaning and preparation, data transformation, classification).
5. Data preparation (outlier detection, data reduction).
6. Decision trees (classification and regression trees).
7. Process of growing a decision tree (Shannon entropy, Gini index). Pruning decision trees. Generating decision rules.
8. Logistic regression. Point estimation of parameters and odds ratio. Interpretation.
9. Statistical inference for logistic regression.
10. Artificial neural networks and its architectures.
11. Association rules.
12. Evaluation of models. Criteria for Evaluating Models.
13. Summary of the lectured subject matter.

Language whose command is required to complete the course:

Slovak

Notes:

Assessment of courses

Total number of evaluated students: 37

A	B	C	D	E	FX
24.32	48.65	18.92	8.11	0.0	0.0

Lecturer: doc. RNDr. Viera Labudová, PhD.

Date of the latest change: 07.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21330/22	**Title of course:** Data Science in R
Type, load and method of teaching activities: **Form of course:** Lecture / Practical **Recommended load of course (number of lessons):** **Per week:** 2 / 2 **Per course:** 26 / 26 **Method of study:** present	
Number of credits: 6	
Recommended semester/trimester of study: 1.	
Degree of study: II.	
Prerequisites:	
Requirements to complete the course: 10 % activity during semester 20% tests 70 % semester project + final exam	
Student workload: Total study load (in hours): 6 credits x 26 hours = 156 hours Distribution of study load Lectures participation: 26 hours Seminar participation: 26 hours Preparation for seminars: 13 hours Preparation for tests: 13 hours Semester project preparation: 52hours Preparation for final exam: 26 hours	
Teaching results: In particular, students acquire the following abilities: - basic knowledge of data processing and visualization in R, - basic knowledge in the field of programming in R, - basic knowledge of project creation in R, - basic knowledge of the possibilities of working with large databases using R. Students acquire in particular the following skills: - ability to use basic tools for data processing, visualization and analysis in R, - using R and RStudio. Students will acquire the following competencies: - practical skills and competencies with the application of methods used to analyze data and solve economic and other problems.	
Indicative content: The aim of this course is to provide knowledge in the field of data analysis in R and tools for their application in solving specific empirical problems. Emphasis is placed on the issues of data processing, selection, modeling and visualization. This course also contains basic information about the possibilities of working with large databases using the R program.	

1. Mathematical operations in R, logical operators and comparison operators, data types in R, definition of variables and vectors, indexing of vectors and operations with vectors, lists.
2. Creation of matrices, operations with matrices, indexing of matrices, creation of table structures using data frames, selection and indexing of data frames and operations with data frames, import and export of data.
3. Basics of programming in R, condition if else, function ifelse, use of loops - for, while, creation of own functions.
4. Basic information about the group of packages tidyverse serving for data import, manipulation, modeling and visualization (packages such as readr, tibble, tidyr, dplyr, ggplot2, forcat, modelr…).
5. Data manipulation, use of dplyr package, selection of variables, filtering of variables, calculation of summary statistics, pipe operator (%>%).
6. Preparation and cleaning of data for data analysis (tidyr), grouping of data according to specific variables, work with categorical data, work with time formats.
7. Working with table structures (tibble), working with relational data, joining data from multiple tables based on keys, filtering using multiple tables.
8. Using the ggplot2 package to create various types of graphs (bar graph, pie graph, line graph, histogram, scatter graph, Boxplot…) and setting selected parameters of individual graphs.
9. Working with the Markdown R tool used to combine text, code and results.
10. Connecting and working with SQL database using dbplyr package. Working with large databases and connecting to other types of databases (dtplyr library, data.table).
11. Formulation and answering of a research question using the construction of a regression model and its testing (tidymodels, modelr).
12. Introduction to machine learning, overview of possibilities of using machine learning in R, application of machine learning using regression.
13. Basic information about the possibilities of data extraction from the web (import.io, rvest…).

Support literature:
1. H. Wickham – G. Grolemund (2017). R for Data Science – visualize, model, transform, tidy and import data. https://r4ds.had.co.nz/index.html
2. J. Bryan – STAT545. https://stat545.com/
3. P. L. de Micheaux, R. Drouilhet, B. Liquet (2013). The R Software – Fundamentals of Programming and Statistical Analysis, Springer.

Syllabus:

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 318

A	B	C	D	E	FX
38.05	15.09	15.09	14.15	15.41	2.2

Lecturer: doc. Ing. Brian König, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin

Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KŠ FHI/IID22320/21	**Title of course:** Demographic Statistics

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 5

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30 % credit written work
70 % final exam

Student workload:
Total study load (in hours): 130 hours
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 13 hours
Preparation for written assignment: 26 hours
Exam preparation: 39 hours

Teaching results:
At the end of the semester, students gain an overview of demographic approaches and opportunities that help analyze and evaluate the current demographic situation in society.
In particular, students acquire the following abilities:
- Students will be able to correctly interpret and analyze demographic rates. They will acquire skill in the construction of mortality tables and life tables in general.
Students acquire in particular the following skills:
- Students will demonstrate knowledge of basic knowledge about the principles of demographic data collection, correctly understand the demographic development in society, the migration situation in the country.
Students will acquire the following competencies:
- Acquired knowledge after completing the subject of demographic statistics enabling the student to perform a basic analysis in the field of population statistics and projections of population development.

Indicative content:
The content of the course is to master the basic methods of analysis of population development, the use of individual sources of demographic data, the acquisition of demographic terminology, demographic indicators, demographic symbolism. The demographic statics part contains the structure of the population mainly by age and sex, but also other structures such as marital status, religion, etc. The demographic dynamics section analyzes demographic events, their correct

interpretation and uses demographic models - mortality, marriage, fertility, divorce, abortion and migration. The course also includes the theoretical basis of the current demographic development.

Support literature:

1. KLUFOVÁ, R., POLÁKOVÁ,, Z. : Demografické metody a analýzy: demografie české a slovenské populace. 1. vyd. Praha: Wolters Kluwer ČR, 2010.308s. ISBN 978-80-7357-546-5
2. KOSCHN, F.: Vybrané demografické modely, 1. vyd. Praha: VŠE, 2002. 51s. ISBN 80-245-0273-9
3. KOSCHN, F.: Kapitoly z ekonomické demografie, 1. vyd. Praha: VŠE, 2005. 52s. ISBN 80-245-0959-8
4. JURČOVÁ, D.: Slovník demografických pojmov, Bratislava: Edícia Akty, 2005. ISBN 80-85659-40-9

The literature will be continuously updated with the latest scientific and professional titles.

Syllabus:

1. Subject, content and structure of demography. Development of demography as a science.
2. Definition of demographic events and demographic phenomena. History of current population records and census.
3. Sources of population data. Census, content and use.
4. Natural movement of the population, its registration and use in demographic analysis.
5. Construction of demographic indicators. Time in demographic analysis and demographic network.
6. Basic structures of the population - by sex and age, other structures.
7. Mortality, mortality intensity indicators. Infant mortality and its decomposition. Standardization mortality.
8. Mortality tables, construction, calculation, use in demography.
9. Marriage and termination of marriages. Wedding tables.
10. Fertility and fertility, fertility rates and reproduction.
11. General characteristics of reproduction.
12. Population estimates and projections of population number and structure.
13. Summary of the lectured subject matter.

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 23

A	B	C	D	E	FX
43.48	43.48	13.04	0.0	0.0	0.0

Lecturer: RNDr. Daniela Sivašová, PhD.

Date of the latest change: 07.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21350/22	**Title of course:** Econometric Modeling
Type, load and method of teaching activities: **Form of course:** Lecture / Practical **Recommended load of course (number of lessons):** **Per week:** 2 / 2 **Per course:** 26 / 26 **Method of study:** present	
Number of credits: 6	
Recommended semester/trimester of study: 1.	
Degree of study: II.	
Prerequisites:	
Requirements to complete the course: individual work and continuous tests 20% project for the final exam 40% final exam 40%	
Student workload: student workload: 156 h, participation in lectures 26 h, participation in seminars 26 h, elaboration of a semester project 62 h, preparation for the final exam 42 h	
Teaching results: Upon successful completion of this course, students will have knowledge of advanced methods of econometric approach to the analysis and modeling of economic phenomena and processes and should be able to use econometric techniques and procedures for different types of data. Students will gain practical skills and competencies with the application of advanced econometric methods in the analysis of economic problems using software R and Python.	
Indicative content: 1. Random variable and its distribution, linear regression model, least squares method, statistical properties of small samples, unbiasedness, efficiency, hypothesis testing, linear hypotheses. 2. Maximum likelihood method, Cramer-Rao theorem, information matrix. 3. Testing of nonlinear hypotheses, Wald test, Lagrange multiplier test, likelihood ratio test, delta method. 4. Estimation of models with restrictions and nonlinear models, Gauss and Newton method, Newton and Raphson method. 5. Generalized least squares method, spherical stochastic term, heteroskedasticity and autocorrelation robust estimators, White estimator and Newey and West estimator. 6. Dynamic models, dynamic multipliers and impulse response functions. 7. Introduction to asymptotic theory, endogenous explanatory variables, instrumental variables, introduction to the method of moments. 8. Generalized method of moments and estimation of forward-looking models. 9. Applications of the time series econometrics models and prognostic models. 10. Applications of the financial econometrics models. 11. Applications of the spatial econometrics models.	

12. Applications of the models in macroeconometric modeling.
13. Applications of the quantitative economics models.

Support literature:

1. Greene, W.H.: Econometric Analysis, 8th ed. Pearson, 2018
2. Kleiber, C., Zeileis, A.: Applied Econometrics with R. Springer, 2008
3. Pesaran, M.H.: Time Series and Panel Data Econometrics. Oxford University Press, 2015
4. Hatrák, M.: Ekonometria. Bratislava: IURA Edition, 2007
5. Angrist, J.D., Pischke, J.S.: Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press, 2009
6. Hayashi, F.: Econometrics. Princeton University Press, 2000

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 329

A	B	C	D	E	FX
15.5	17.33	27.05	18.54	19.15	2.43

Lecturer: prof. Ing. Martin Lukáčik, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KŠ FHI/IID22220/21	**Title of course:** Economic Statistics I

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30% assignment
70% final paper (30% theoretical part, 40% practical – examples solution)

Student workload:
Total study load (in hours): 156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 13 hours
Preparation for written assignment: 39 hours
Final paper preparation: 52 hours

Teaching results:
At the end of the semester, students will have an overview of indicators and statistical methodological tools suitable for the analysis of economic phenomena at the level of the national economy, more specifically:
In particular, students acquire the following abilities:
After completing the course, students will be able to apply appropriate statistical methods in the analysis of economic phenomena at the national economic level.
Students acquire in particular the following skills:
Students will be able to understand statistical indicators and their explanatory power in relation to economic phenomena. They will gain knowledge about the possibilities of analysis of economic phenomena at the level of the national economy.
Students will acquire the following competencies:
Students will be able to select appropriate statistical indicators for economic analysis, will be able to interpret obtained results correctly and make appropriate decisions based on them.

Indicative content:
The course provides knowledge about methods of statistical analysis, evaluation and comparison of changes in indicators of labor, material inputs and outputs. It presents ways of constructing intensity indicators describing the relationships between inputs and outputs of the economic process at the macroeconomic level.

Support literature:

1. HURBÁNKOVÁ, Ľ. – SIVAŠOVÁ, D.: Hospodárska štatistika I. Bratislava: Ekonóm, 2018
2. FRIEDRICH, V. – MAJOVSKÁ, R.: Výběr z ekonomické statistiky. Praha: Wolters Kluwer ČR,
3. 2010
4. GIOVANNINI, E.: Understanding Economic Statistics: an OECD perspective. Paris. OECD 2008
5. HINDLS, R.: Statistika pro ekonomy. Praha: Professional Publishing, 2007
6. JÍLEK, J. – MORAVOVÁ, J.: Ekonomické a sociální indikátory: od statistiky k poznatkum. Praha: Futura, 2007
7. JÍLEK J. a kol.: Nástin sociálněhospodářské statistiky. VŠE Praha. 2005
8. ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT STAFF: OECD Factbook 2005: Economic, Environmental and Social statistics. OECD, 2005
9. ULLAH, A.: Handbook of applied economic statistics. CRC Press, 1998

Literature will be continuously updated with the latest scientific and professional titles.

Syllabus:

1. Introduction to economic statistics I – definition, subject of research, task.
2. Methodical apparatus of economic statistics – methodical tools taken from the theory of statistics (rate of difference, absolute geometric deviation, average absolute geometric deviation, geometric variance, contribution method, measurement of elasticity).
3. Methodological apparatus of economic statistics – methodological tools developed in economic statistics (classifications, quantification of the structure of aggregates and its changes).
4. Methodological apparatus of economic statistics – methodological tools developed in economic statistics (methods of index analysis, procedures for quantification of absolute changes of aggregates).
5. Demography statistics – demographic statics, demographic dynamics.
6. The aging process and the impact on labor resources.
7. Labor input statistics – extensive and intensity indicators, analysis of the development of the average rate of economic activity and the average unemployment rate.
8. Quantification of absolute changes in the number of economically active persons and the number of unemployed.
9. Statistics of labor input costs – extensive and intensity indicators, analysis of the development of the average wage and total wages.
10. Unit labor costs – calculation, conditions of development, valuation, measurement of inflation.
11. Statistics of material inputs – extensive and intensity indicators, measuring the elasticity of capital, application of the contribution method.
12. Output statistics – equilibrium relations between sources and use of production, macroeconomic indicators of output, methods of calculating gross domestic product.
13. Valuation of macroeconomic aggregates, nominal and real aggregates, statistical deflation.

Language whose command is required to complete the course:

Slovak

Notes:

Assessment of courses

Total number of evaluated students: 21

A	B	C	D	E	FX
9.52	42.86	28.57	9.52	9.52	0.0

Lecturer: Ing. Ján Bolgáč, Ing. Ľubica Hurbánková, PhD., Ing. Katarína Moravčíková, PhD.
Date of the latest change: 07.02.2022
Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KŠ FHI/IID22360/21	**Title of course:** Economic Statistics II

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30% assignment
70% final paper (30% theoretical part, 40% practical – examples solution)

Student workload:
Total study load (in hours): 156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 13 hours
Preparation for written assignment: 39 hours
Final paper preparation: 52 hours

Teaching results:
At the end of the semester, students will have an overview of indicators and statistical methodological tools suitable for the analysis of economic phenomena at the enterprise level, more specifically:
In particular, students acquire the following abilities:
- After completing the course, students will be able to apply appropriate statistical methods in the analysis of economic phenomena at the enterprise level.
Students acquire in particular the following skills:
- Students will be able to measure, evaluate and analyze phenomena and processes taking place at the enterprise level. They will be able to use the available methodological tools and methodology that they have acquired in the study of statistical methods and procedures that are suitable for applications in the field of business statistics.
Students will acquire the following competencies:
- Students will be able to understand statistical indicators and their explanatory power in relation to economic phenomena. They will be able to apply appropriate statistical methods in their own analytical work and make appropriate decisions based on this.

Indicative content:
The course provides knowledge about methods of statistical analysis, evaluation and comparison of changes of economic indicators at company level. Lists construction methods of intensity indicators

describing the relationships between inputs and outputs of the economic process at the enterprise level.

Support literature:

1. SODOMOVÁ, E. a kol.: Hospodárska štatistika II. Bratislava: Ekonóm, 2019
2. GOVANNINI, E.: Understanding economic statistics: an OECD perspective. 2008
3. ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT STAFF: OECD Factbook 2005: Economic, Environmental and Social statistics. OECD, 2005
4. KONTŠEKOVÁ, O.: Úvod do hospodárskej štatistiky. Bratislava: ES EU, 1994
5. KONTŠEKOVÁ, O. a kol.: Základy hospodárskej štatistiky. Bratislava: EKONÓM, 2000
6. ULLAH, A.: Handbook of applied economic statistics. CRC Press, 1998
7. CHAJDIAK, J. a kol. 1989. Ekonomická štatistika Príklady. Bratislava: ALFA, 1989
8. KOVAČKA, M. 1984. Ekonomická štatistika. Bratislava: Alfa, 1984

Literature will be continuously updated with the latest scientific and professional titles.

Syllabus:

1. Introduction to economic statistics II – state statistics and its tasks.
2. Labor force statistics – measuring the status, structure, movement and use of labor force, balance of working time, indicators of labor use.
3. Wage statistics – goals of wage statistics, basic indicators of wages, analysis of the level and development of wages, rates of differentiation and concentration of wages.
4. Production statistics – definition of production, units of production, types of production indicators according to content, production indicators, production development.
5. Production of selected industries – industry, construction, agriculture, services.
6. Production of selected industries – agriculture, services.
7. Foreign trade statistics – foreign trade indicators, INTRASTAT and EXTRASTAT system, publication of foreign trade statistics data, structure of foreign trade turnover, development of foreign trade turnover.
8. Capital statistics – theoretical foundations, definition of indicators, analysis of indicators of tangible fixed assets.
9. Cost statistics – breakdown of costs, cost indicators (cost and cost-effectiveness), cost development.
10. Labor productivity statistics – types of labor productivity indicators, analysis of the impact of factors on the level and development of labor productivity (breakdown of indicators), analysis of labor productivity development.
11. Stocks statistics – status of stocks, indicators of stocks turnover rate and their relationship, development of stocks turnover rate indicators.
12. Statistics on the use of machinery and equipment – synthetic indicators, capacity indicators.
13. Price statistics – the role and subject of price statistics, characteristics of the price level, types of price indices, price indices used in the economic and social field.

Language whose command is required to complete the course:

Slovak

Notes:

Assessment of courses

Total number of evaluated students: 21

A	B	C	D	E	FX
33.33	42.86	14.29	9.52	0.0	0.0

Lecturer: Ing. Ján Bolgáč, Ing. Ľubica Hurbánková, PhD., Ing. Katarína Moravčíková, PhD.

Date of the latest change: 07.02.2022
Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21210/22	**Title of course:** Environmental Models

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 5

Recommended semester/trimester of study: 4.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30% semester seminar work, resp. project,
10% continuous processing of tasks, worksheets resp. case studies.
60% written exam.

Student workload:
130 hours
26 hours of lectures,
26 hours of exercise,
52 hours of self-study in preparation for the exam,
26 hours elaboration of a semester project.

Teaching results:
Upon successful completion of the course, students will acquire the following knowledge:
- basic knowledge of environmental and economic processes that respect environmental requirements,
- knowledge of modeling in distribution and production logistics, in the supply chain process and in the deployment of models,
- basic knowledge of the application of optimization models in various economic and environmental areas.

Upon successful completion of the course, students will acquire the following skills:
- ability to use basic model approaches in both economic and economical-environmental processes,
- based on the set conditions, appropriately formulate the problem in economic processes and supplement it with an environmental aspect and then propose a suitable solution.

Upon successful completion of the course, students will acquire the following competencies:
- practical skills and knowledge associated with the management of economic processes about the environmental aspect.
- knowledge in the environment of optimization with the application of methods and algorithms in the modeling of production processes, logistics processes, data analysis.

Indicative content:
1. Environmental aspects in economic processes. Optimization of economic processes. Goal setting and prioritization.

2. Circular economy and circular economy. General principles and specific tools of mathematical modeling of economic and ecological systems.
3. Eco-eco approach. Aggregation of target criteria. Multi-criteria decision making. Optimization processes and their modification. Evaluation of eco-efficiency of models.
4. Circular economy and circular economy. Product life cycle and waste management. Product design.
5. Reverse logistics. Green logistics.
6. Environmental modeling in distribution logistics. Models of transport.
7. Environmental modeling in the procurement and supply process.
8. Environmental modeling in production logistics.
9. Deployment of models in environmental modeling. Modeling of consumption of renewable and non-renewable resources.
10. Modeling in waste management and the role of distribution and transport.
11. Agro-ecology and industrial ecology. Models of air pollution and water pollution.
12. Economic and legislative motivational tools to support the objectives of environmental policy, and climate protection.
13. Human and environmental models, global trends and their modeling. Global environmental and demographic trends.

Support literature:
1. Metódy logistiky prepravy, rozmiestňovania a rozvrhovania, (Aplikácie matematických modelov v jazyku Python), Ivan Brezina – Juraj Pekár – Pavel Gežík, Bratislava : Letra Edu, 2020
2. Teória grafov pre ekonómov, Ivan Brezina – Pavel Gežík, Bratislava : Letra Edu, 2018
3. Modelovanie reverznej logistiky - optimalizácia procesov recyklácie a likvidácie odpadu. Ivan Brezina a kol., Bratislava : Vydavateľstvo EKONÓM, 2009.
4. Quantitative models for reverse logistics. Moritz Fleischmann, Rotterdam : Selbstverl 2000.
5. Reverse Logistics, Quantitative Models for Closed-Loop Supply Chains, Rommert Dekker a kol., Berlin : Springer-Verlag, 2004

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 4

A	B	C	D	E	FX
100.0	0.0	0.0	0.0	0.0	0.0

Lecturer: prof. Ing. Ivan Brezina, CSc., Ing. Pavel Gežík, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21360/22	**Title of course:** Financial Econometrics

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30 % work at seminars and writing of projects
70 % combined final exam

Student workload:
156 hours
26 hours lecture attendance
26 hours seminar attendance
26 hours preparation for lectures
26 hours preparation for seminars
26 hours writing a seminar paper
26 hours preparation for final exam

Teaching results:
Upon successful completion of the course, students will acquire the following knowledge:
- basic knowledge of the econometric approach to the analysis and modeling of financial time series (with emphasis on return series and their volatility),

Upon successful completion of the course, students will acquire the following skills:
- ability to use selected econometric approaches in the analysis of time series of returns and their volatility,
- skills in using econometric software to analyze financial time series

Upon successful completion of the course, students will acquire the following competencies:
- practical skills and competencies associated with the application of models and methods of financial econometrics in the analysis of financial time series (R software).

Indicative content:
1. Econometrics of financial time series - basic properties of financial time series, return series. Econometric software for financial time series analysis.
2. Box-Jenkins ARIMA methodology (AR, MA, ARMA processes, integrated processes). Testing the existence of a unit root.
3. Modeling of autoregressive conditional heteroskedasticity - ARCH class models. Basic concepts, methodology.

4. One-dimensional ARCH-class models - linear and nonlinear. Estimation of parameters in one-dimensional ARCH-class models, diagnostic checking of residuals.
5. Selection of a suitable type of ARCH-class model. Volatility forecasting.
6. Efficient market hypothesis and seasonal anomalies.
7. Regime-switching models. Models with regimes determined by observable variables - TAR models, models with regimes determined by unobservable variables - Markov regime-switching models (MSW).
8. Markov regime-switching GARCH models (MS-GARCH).
9. Investigation of interactions between time series - correlation analysis, cross-sectional standard deviation, multidimensional ARCH-class models (MGARCH).
10. MGARCH - basic concepts, methodology. BEKK and VECH models.
11. MGARCH - CCC and DCC models.
12. Estimation of parameters in MGARCH models.
13. Application of MGARCH models in the analysis of stock markets linkages. Examining the effect of the transmission of "contagion" between stock markets.

Support literature:

1. BROOKS, C.: Introductory Econometrics for Finance. Cambridge: Cambridge University Press, 2008. 648 s.
2. FRANSES, P.H. – DIJK, D. van: Non-Linear Time Series Models in Empirical Finance. Cambridge: Cambridge University Press, 2000. 280 s.
3. RUBLÍKOVÁ, E. – PRÍHODOVÁ, I.: Analýza vybraných časových radov-ARIMA modely. Bratislava: EKONÓM, 2008. 216s.
4. CIPRA, T.: Finanční ekonometrie. Praha: Ekopress, 2013. 538 s.

Syllabus:

Language whose command is required to complete the course:
English

Notes:

Assessment of courses
Total number of evaluated students: 15

A	B	C	D	E	FX
26.67	33.33	40.0	0.0	0.0	0.0

Lecturer: doc. Ing. Michaela Chocholatá, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21220/22	**Title of course:** Financial Modeling

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30 % work at seminars and writing of projects
70 % combined final exam

Student workload:
156 hours
26 hours lecture attendance
26 hours seminar attendance
26 hours preparation for seminars
26 hours writing a seminar paper
52 hours preparation for final exam

Teaching results:
Upon successful completion of the course, students will acquire the following knowledge:
- knowledge of financial market analysis,
- knowledge of portfolio theory,
- knowledge of the application of knowledge of portfolio theory in determining investment strategies,
- knowledge of machine learnig tools usable in the management of investment strategies.

Upon successful completion of the course, students will acquire the following skills:
- ability to use portfolio theory models in setting investment strategies,
- control of adequate software for solving portfolio theory tasks.

Upon successful completion of the course, students will acquire the following competencies:
- practical skills and competencies with the application of portfolio theory models in the analysis of financial markets using adequate software.

Indicative content:
1. Evaluation of investment projects with financial mathematics tools.
2. Input financial data (stock markets) and their graphical interpretation.
3. Return and risk and their measurement: Concepts of risk measurement (standard deviation, absolute deviation, VaR, CVaR, DrawDown).
4. Simulation of returns on financial assets.
5. Categories of risk and return rates.

6. The concept of portfolio. Investment risk. Systematic and non-systematic risk. The concept of diversification.
7. Markowitz's approach to portfolio selection. Expected return and portfolio risk level. Analysis of the set of all portfolios. A set of effective portfolios. Method of generating efficient portfolios.
8. Models of portfolio selection in the area of return and risk.
9. Analysis of effective portfolios: Analysis of portfolios from risk-free and risky investments. Market portfolio and its properties.
10. CAPM model - modeling the mechanism of creating the equilibrium price of capital assets.
11. Portfolio performance and portfolio selection models.
12. Machine learning tools in finance.
13. Use of Machine learning tools in portfolio selection.

Support literature:

1. Paiva, Felipe & Cardoso, Rodrigo & Hanaoka, Gustavo & Duarte, Wendel. (2018). Decision-Making for Financial Trading: A Fusion Approach of Machine Learning and Portfolio Selection. Expert Systems with Applications. 115. 10.1016/j.eswa.2018.08.003.
2. X. Yuan, J. Yuan, T. Jiang and Q. U. Ain, "Integrated Long-Term Stock Selection Models Based on Feature Selection and Machine Learning Algorithms for China Stock Market," in IEEE Access, vol. 8, pp. 22672-22685, 2020, doi: 10.1109/ACCESS.2020.2969293.
3. Guan, Hao and Zhiyong An. “A local adaptive learning system for online portfolio selection.” Knowl. Based Syst. 186 (2019): n. pag.
4. Kim, J.; Shin, S.; Lee, H.S.; Oh, K.J. A Machine Learning Portfolio Allocation System for IPOs in Korean Markets Using GA-Rough Set Theory. Sustainability 2019, 11, 6803. https://doi.org/10.3390/su11236803
5. Pekár J.: Modely matematického programovania na výber portfólia. 1. vyd. - Bratislava : Vydavateľstvo EKONÓM, 2015.

Syllabus:

Language whose command is required to complete the course:
Slovak, Eglish

Notes:

Assessment of courses
Total number of evaluated students: 103

A	B	C	D	E	FX
16.5	21.36	23.3	21.36	17.48	0.0

Lecturer: prof. Mgr. Juraj Pekár, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21390/22	**Title of course:** Forecasting Models

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2., 4.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
project for the final exam 60%
final exam 40%

Student workload:
student workload: 156 h, participation in lectures 26 h, participation in seminars 26 h, elaboration of a semester project 62 h, preparation for the final exam 42 h

Teaching results:
Upon successful completion of this course, students will have knowledge of prognostic methods and models and should be able to use these procedures for different types of time series.
Students will gain practical skills and competencies with the application of forecasting methods used in economic variables using software R and Python.

Indicative content:
1. Basic concepts, evaluation measures, information set, loss function, optimal forecast.
2. Decomposition and smoothing of time series.
3. Moving averages and trend models.
4. Forecasting using exponential smoothing models.
5. Box-Jenkins methodology of ARIMA models – detection, estimation, and forecasting.
6. Box-Jenkins methodology of SARIMA models – detection, estimation, and forecasting.
7. Regression models. Forecasting using an econometric model.
8. Dynamic regression models.
9. Vector autoregressive models.
10. Volatility forecasting.
11. Nonlinear models, threshold autoregressive models (TAR).
12. Advanced prognostic models. Intervention analysis, neural networks.
13. Combined forecasts.

Support literature:
1. Hyndman, R.J., Athanasopoulos, G.: Forecasting: principles and practice. 3rd ed. OTexts, 2021.
2. Gonzale-Rivera, G.: Forecasting for Economics and Business. Addison Wesley, 2013.

3. Diebold, X.: Forecasting in Economics, Business, Finance and Beyond, University of Pennsylvania, 2017.
4. Shmueli, G., Lichtendahl, K.C.: Practical Time Series Forecasting with R: A Hands-On Guide, 2nd ed. Axelrod Schnall Publishers, 2016.
5. Carnot, N., Koen, V., Tissot, B.: Economic Forecasting. Palgrave Macmillan, 2005.

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 12

A	B	C	D	E	FX
66.67	33.33	0.0	0.0	0.0	0.0

Lecturer: prof. Ing. Martin Lukáčik, PhD., doc. Ing. Brian König, PhD., Ing. Adriana Lukáčiková, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21260/22	**Title of course:** Game Theory

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
40 % final paper and continuous testing
60 % final exam

Student workload:
Total study load (in hours): 6 credits x 26 hours = 156 hours
Lectures participation: 26 hours
Seminars participation: 26 hours
Final paper preparation: 52 hours
Preparation for the exam and continuous tests: 52 hours

Teaching results:
In particular, students acquire the following abilities:
- basic knowledge of conflict decision-making situations, types of conflicts, decision-making and the possibility of taking an equilibrium strategy in conflict decision-making situations in the case of antagonistic and non-antagonistic conflicts

Students acquire in particular the following skills:
- skills to analyze and solve conflicting decision-making situations

Students will acquire the following competencies:
- practical skills and competencies with the application of optimization methods in the field of conflict decision-making situations, their analysis and solving using appropriate software (Python language)

Indicative content:
1, Decision theory, utility theory and related paradoxes
2, Games against nature
3, Basic concepts of conflict situation modeling, two player games, game definition, game classification, problems of equilibrium decision making in games
4, Bimatrix games, equilibrium solution of the game, solution of the game in pure strategies, solution of the game in mixed strategies (special types of games).
5, Bimatrix games, solving the game in mixed strategies (special types of games), Kuhn-Tucker's optimality conditions, solving the game in mixed strategies, cooperative solving

6, Matrix games, equilibrium strategies of players, their existence and properties, solving games in pure strategies, solving games in mixed strategies (special types of games)
7, Matrix games, solving games in mixed strategies, relationships between matrix games and linear programming problems
8, Multiplayer games, non-cooperative game solutions
9, Multiplayer games, cooperative game solutions
10, Multiplayer games, voting games
11, Repeated games
12, Extensive form games
13, Application of game theory in various fields (examples of various practical applications)

Support literature:

Chobot M. – Turnovec F. – Ulašín V.: Teória hier a rozhodovania. Alfa, Bratislava 1991
Goga M.: Teória hier. Iura Edition, 2012
Dlouhý M. – Fiala, P.: Teorie ekonomických a politických her. Oeconomica, 2015
Čičková a kol.: Vybrané aplikácie teórie hier. Letra Edu, 2019
Gibbons R. Game theory for applied economics. Princenton University Press, Princenton 1992.

Syllabus:

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 16

A	B	C	D	E	FX
50.0	18.75	25.0	6.25	0.0	0.0

Lecturer: doc. Ing. Zuzana Čičková, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KŠ FHI/IID22100/21	**Title of course:** Machine Learning

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 1.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
40% assignment in Python
60% final exam

Student workload:
Total study load (in hours): 156
Lecture participation: 26
Seminar participation: 26
Preparation for seminars: 26
Written assignments: 38
Final exam preparation: 40

Teaching results:
Successful completion of the course is a guarantee that students will gain a basic overview of the nature and possibilities of machine learning in practice.
Knowledge
Students acquire:
− knowledge of basic concepts, principles, methods and procedures used in machine learning,
− knowledge of Python programming language
Skills
− students will learn to implement statistical methods into codes
− students will be able to construct machine learning models and algorithms in the Python programming language and will know how to combine them in solving problems
− students will learn to adequately apply machine learning procedures and methods
− students will learn to use libraries in Python, including the popular Scikit-learn and TensorFlow for machine learning
Competences
− students will be able to use the acquired knowledge and skills in solving tasks of machine learning

Indicative content:
The subject represents the area of machine learning, which is currently being intensively developed in close connection with artificial intelligence. It gives an overview of the basic types of machine learning, the main problems and methods and lists some typical algorithms.

Support literature:

1. MŰLLER, A. C., & GUIDO, S. (2016). Introduction to Machine Learning with Python: A Guide for Data Scientists (1st ed.). O'Reilly Media. ISBN 978-1-449-36941-5
GÉRON, A. (2019). Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems (2nd ed.). O'Reilly Media. ISBN 978-1492032649
2. AMR, T. (2020). Hands-On Machine Learning with scikit-learn and Scientific Python Toolkits: A practical guide to implementing supervised and unsupervised machine learning algorithms in Python. Packt Publishing.
3. ALBON, C. (2018). Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning (1st ed.). O'Reilly Media. ISBN 978-1491989388
4. LIU, Y. (2020). Python Machine Learning By Example: Build intelligent systems using Python, TensorFlow 2, PyTorch, and scikit-learn (3rd ed.). Packt Publishing. ISBN 978-1800209718

Syllabus:

1. Introduction to machine learning and Python
2. Data preparation and data cleaning
3. Training, validation, and test sets
4. Classification a Regression
5. K-Nearest Neighbor
6. Random Forest and Decision Trees
7. Support Vector Machine algorithm
8. Naïve Bayes algorithm
9. Unsupervised learning. Clustering – K means clustering
10. Artificial Neural Networks I
11. Artificial Neural Networks II
12. Model validation. Model quality evaluation criteria.
13. Summary

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 629

A	B	C	D	E	FX
9.06	28.46	36.09	20.19	6.04	0.16

Lecturer: Ing. Silvia Komara, PhD., doc. Ing. Mária Vojtková, PhD.

Date of the latest change: 07.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21900/22	**Title of course:** Master Thesis and its Defense

Type, load and method of teaching activities:
Form of course:
Recommended load of course (number of lessons):
Per week: Per course:
Method of study: present

Number of credits: 10

Recommended semester/trimester of study:

Degree of study: II.

Prerequisites:

Requirements to complete the course:

Student workload:

Teaching results:

Indicative content:

Support literature:

Syllabus:

Language whose command is required to complete the course:

Notes:

Assessment of courses
Total number of evaluated students: 100

A	B	C	D	E	FX
37.0	33.0	18.0	4.0	8.0	0.0

Lecturer:

Date of the latest change: 30.03.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21910/22	**Title of course:** Models and Methods of Operations Research, Statistics and Econometrics

Type, load and method of teaching activities:
Form of course:
Recommended load of course (number of lessons):
Per week: Per course:
Method of study: present

Number of credits: 10

Recommended semester/trimester of study:

Degree of study: II.

Prerequisites:

Requirements to complete the course:

Student workload:

Teaching results:

Indicative content:

Support literature:

Syllabus:

Language whose command is required to complete the course:

Notes:

Assessment of courses
Total number of evaluated students: 20

A	B	C	D	E	FX
35.0	20.0	15.0	15.0	15.0	0.0

Lecturer:

Date of the latest change: 30.03.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21270/22	**Title of course:** Multicriteria Decision-Making

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30 % work at seminars and writing of projects
70 % combined final exam

Student workload:
Total study load (in hours): 6 credits x 26 hours = 156 hours
26 hours lecture attendance
26 hours seminar attendance
26 hours preparation for lectures
26 hours preparation for seminars
26 hours writing a seminar paper
26 hours preparation for final exam

Teaching results:
Upon successful completion of the course, students will acquire the following knowledge:
- knowledge of multicriteria decision-making for the analysis of economic phenomena and processes,
- knowledge of multicriteria decision-making to model economic phenomena and processes.
- knowledge of multi-criteria decision-making to evaluate and set strategies for economic processes.
Upon successful completion of the course, students will acquire the following skills:
- ability to use models and methods of multicriteria decision making,
- control of adequate software to solve multicriteria decision-making tasks.
Upon successful completion of the course, students will acquire the following competencies:
- practical skills and competencies associated with the application of models and methods of multicriteria decision-making in the analysis of economic problems in the field of economic practice using adequate software.

Indicative content:
The role of multicriteria decision making. Geometric interpretation of the problem of multicriteria decision making.
2. Non-dominance and effectiveness of the solution. The concept of the dominant set. The principle of optimality and acceptability in multicriteria decision-making problems.
3. Goal programming. Distance metrics.

4. Archimedean goal programming. Min-max goal programming.
5. Lexicographic goal programming.
6. Efficient solutions and goal programming problems.
7. Methods for generation of efficient solutions – The weighted sum method.
8. Methods for generation of efficient solutions – The constraint method.
9. Methods for generation of efficient solutions - Ideal point (ideal alternative).
10. Interactive methods of multicriteria decision making - STEM method.
11. Multiple Attribute Decision Making (MADM) methods.
12. PROMETHEE methods.
13. Data Envelopment Analysis (DEA)

Support literature:

1. Steuer, R. E.: Multiple Criteria Optimization: Theory, Computation, and Application, John Willey & Sons 1986.
2. PEKÁR, Juraj - FURKOVÁ, Andrea. Prípadové štúdie z viackriteriálneho rozhodovania. Bratislava : Vydavateľstvo EKONÓM, 2014.
3. Vincent Barichard, Matthias Ehrgott, Xavier Gandibleux, and Vincent T'Kindt. 2009. Multiobjective Programming and Goal Programming: Theoretical Results and Practical Applications (1st. ed.). Springer Publishing Company, Incorporated.
4. Constantin Zopounidis, Michael Doumpos: Multiple Criteria Decision Making: Applications in Management and Engineering 1st ed. 2017 Edition

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 17

A	B	C	D	E	FX
11.76	23.53	23.53	17.65	23.53	0.0

Lecturer: prof. Mgr. Juraj Pekár, PhD., doc. Ing. Andrea Furková, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KŠ FHI/IID22260/21	**Title of course:** Multivariate Statistical Methods

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
40 % semester project processed in SAS Enterprise Guide
60 % final exam

Student workload:
Total study load (in hours): 156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 13 hours
Elaboration of Semester project: 26 hours
Presentation of Semester project: 13 hours
Preparation for final exam: 52 hours

Teaching results:
At the end of the semester, students will have a good overview of multivariate statistical methods, which are currently widely used in various areas of economic practice, such as:
Knowledge
- Students will distinguish multivariate statistical methods in terms of their classification and will know the basic principles, starting points and conditions of use of individual multivariate statistical methods. In the final exam, students will use this knowledge to solve practical problems using the statistical software package SAS.
Skills
- Students will be able to design and identify a suitable multivariate statistical method to achieve the goal of analysis, indicating the possibilities of its further use.
Competencies
- Students will know how to: apply a suitable multivariate statistical method, verify the conditions of its use, interpret and present the results of the analysis;
- evaluate the acquired knowledge in solving real economic and social tasks in practice using the SAS system.

Indicative content:
Multivariate statistical analysis is one of the most important statistical tools characterizing various phenomena. It is accompanied by wide range of methods and procedures that address multivariate

problems in various respects. The course provides theoretical analysis of multivariate statistical methods, control of their basic principles, implementation of individual steps of analysis of the methods, the conditions under which individual methods are used as well as their application.

Support literature:

1. VOJTKOVÁ, M. - STANKOVIČOVÁ, I.: Viacrozmerné štatistické metódy s aplikáciami v softvéri SAS. Bratislava: Letra Edu, 2020. 2. vydanie. ISBN 978-80-89962-58-7 (print), ISBN 978-80-89962-59-4 (online)
2. MELOUN, M. – MILITKÝ, J. – HILL, M: Statistická analýza vícerozměrných dat v příkladech. Praha: Karolinum, 2017. ISBN 80-200-1254-0
3. MELOUN, M. – MILITKÝ, J.: Interaktivní statistická analýza dat. Praha: Karolinum, 2012. ISBN 80-200-1254-0
4. MELOUN, M. – MILITKÝ, J.: Kompendium statistického zpracování dat. Praha: Karolinum, 2012. ISBN 80-200-1254-0
5. HEBÁK, P. - HUSTOPECKÝ, J. - JAROŠOVÁ, E. – PECÁKOVÁ, I.: Vícerozměrné statistické metódy (1). Informatorium, Praha 2004. ISBN 80-7333-025-3
6. HEBÁK, P. - HUSTOPECKÝ, J. – MALÁ, I.: Vícerozměrné statistické metódy (2). Informatorium, Praha 2005. ISBN 80-733-036-9
7. HEBÁK, P. - HUSTOPECKÝ, J. - PECÁKOVÁ, I. – PRŮŠA, M. – ŘEZÁNKOVÁ,H. – VLACH, P. – SVOBODOVÁ, A.. : Vícerozměrné statistické metódy (3). Praha: Informatorium, 2005. ISBN 80-7333-039-3
8. BAKYTOVÁ, H.- BODJANOVÁ, S.- RUBLÍKOVÁ, E.: Viacrozmerná analýza. Bratislava: ES VŠE, 1988 resp. 1991.
9. TABACHNICK, B.G. – FIDELL, L. S.: Using Multivariate statistics. 6th ed., Edinburg: Pearson Education Limited, 2014. ISBN 13: 978-1-292-02131-7
10. HAIR, J. F. - BLACK, W. C. - BABIN, B. J. - ANDERSON, R. E.: Multivariate data analysis. 7th ed. New York: Macmillan Publishing Company, 2010. ISBN 13: 978-0138132637
11. SHARMA, S.: Applied multivariate techniques. New York: John Wiley & Sons, 1996. ISBN 0-471-31064-6
12. RENCHER. A. C..: Methods of Multivariate Analysis. New York: John Willey & Sons, 1995. ISBN 0-471-57152-0
Literature will be continuously updated with the latest scientific and professional titles.

Syllabus:

1. Basic concepts of multivariate analysis.
2. Methods of multicriteria evaluation.
3. Principal component analysis.
4. Factor analysis. Methods for estimating factor model parameters.
5. Rotation of factors. General scheme of application of factor analysis.
6. Comparison of factor analysis and principal component analysis.
7. Cluster analysis. Hierarchical clustering methods.
8. Non-hierarchical clustering methods. Interpretation of clusters.
9. Canonical correlation analysis.
10. Discriminant analysis. Analytical task of discriminant analysis.
11. Classification task of discriminant analysis. Verification of classification accuracy.
12. Logistic regression.
13. Summary of lectured topics.

Language whose command is required to complete the course:

Slovak

Notes:

Assessment of courses

Total number of evaluated students: 21

A	B	C	D	E	FX
19.05	23.81	14.29	28.57	14.29	0.0

Lecturer: doc. Ing. Mária Vojtková, PhD.

Date of the latest change: 07.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21240/22	**Title of course:** Network Analysis

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30% semester seminar work, resp. project,
10% continuous processing of tasks, worksheets resp. case studies.
60% written exam.

Student workload:
156 hours.
26 hours of lectures,
26 hours of exercise,
70 hours of self-study in preparation for the exam,
34 hours elaboration of a semester project.

Teaching results:
The aim of the course is to provide basic knowledge of graph theory, network analysis and application of adequate models and methods. Within the study program Operational Research and Econometrics, the course is aimed at fulfilling the objectives of demonstrating advanced knowledge in the field of operational research. Various scientific methods, procedures and algorithms are combined within the course. Students will gain skills in using network analysis techniques and procedures using Python software.
Upon successful completion of the course, students will acquire the following knowledge:
- basic knowledge of graph theory and the use of graph theory in modeling some economic processes,
- basic knowledge of project management, network analysis and the use of network analysis models in the optimization of consecutive economic and managerial processes,
- basic knowledge of the application of network analysis methods in various economic areas.
Upon successful completion of the course, students will acquire the following skills:
- ability to use basic concepts, techniques and algorithms of graph theory, network analysis, scheduling theory,
- control of corresponding software, software products Excel, Python, specialized software products for planning consecutive processes,
- use the Python programming language to solve their own practical tasks in the field of production planning, logistics ...

Upon successful completion of the course, students will acquire the following competencies:
- practical skills and competencies with the application of methods and algorithms in modeling production processes, logistics processes, data analysis using Python software.

Indicative content:

1. Introduction to graph theory, its history, use and properties of graphs, descriptions of graph structure.
2. Acyclic graphs, spanning tree graphs, decision tree graphs, UML.
3. Paths in the graph. Eulerian and Hamiltonian paths and circuits. The problem of the shortest path.
4. Modifications of roads in the graph.
5. Roundabouts. Computational complexity of roundabouts. Optimization, heuristic, and metaheuristic algorithms for solving roundabouts.
6. Flows in graphs.
7. Introduction to project management, main properties of graphs for project management. Node-oriented and edge-oriented graphs and their creation.
8. Project management methods. CPM method.
9. Cost and probabilistic analysis in project management. PERT method. MPM method.
10. Software tools in project management. Use of MS Excel, Python.
11. Scheduling theory. Optimization of production processes on one and more service devices.
12. Location models.
13. Use of graph theory in selected economic problems (production processes, logistics processes…).

Support literature:

1. Teória grafov pre ekonómov, Ivan Brezina – Pavel Gežík, Bratislava : Letra Edu, 2018
2. Kvantitatívne metódy projektového riadenia pre ekonómov, Ivan Brezina – Pavel Gežík, Bratislava : Letra Edu, 2020
3. Metódy logistiky prepravy, rozmiestňovania a rozvrhovania, (Aplikácie matematických modelov v jazyku Python), Ivan Brezina – Juraj Pekár – Pavel Gežík, Bratislava : Letra Edu, 2020
4. Sieťová analýza, Ivan Brezina – Pavel Gežík - Zuzana Čičková. Bratislava : Vydavateľstvo EKONÓM, 2012.
5. Kvantitatívne metódy na podporu logistických procesov, Ivan Brezina – Pavel Gežík - Zuzana Čičková. Bratislava : Vydavateľstvo EKONÓM, 2009.

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 17

A	B	C	D	E	FX
35.29	5.88	11.76	29.41	17.65	0.0

Lecturer: prof. Ing. Ivan Brezina, CSc., Ing. Pavel Gežík, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person

responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21231/22	**Title of course:** Optimal Programming I
Type, load and method of teaching activities: **Form of course:** Lecture / Practical **Recommended load of course (number of lessons):** **Per week:** 2 / 2 **Per course:** 26 / 26 **Method of study:** present	
Number of credits: 6	
Recommended semester/trimester of study: 1., 3.	
Degree of study: II.	
Prerequisites:	
Requirements to complete the course: 30 % work at seminars and writing of projects 70 % combined final exam	
Student workload: 156 hours 26 hours lecture attendance 26 hours seminar attendance 26 hours preparation for lectures 26 hours preparation for seminars 26 hours writing a seminar paper 26 hours preparation for final exam	
Teaching results: Upon successful completion of the course, students will acquire the following knowledge: - knowledge and understanding of the possibilities of using optimal programming approaches as instruments to support decision-making, -knowledge and understanding of selected methods for solving optimization problems of linear, integer and bivalent programming. Upon successful completion of the course, students will acquire the following skills: - ability to use selected methods for solving linear, integer and bivalent programming problems, - ability to work with Python software system and with Solver for Excel software system for solving linear, integer and bivalent programming problems. Upon successful completion of the course, students will acquire the following competencies: -practical skills and competencies associated with the application of models and methods of linear, integer and bivalent programming in the analysis of specific decision-making tasks using adequate software (Python, Solver for Excel).	
Indicative content: 1. Optimal programming as an instrument to support decision making. Overview of mathematical methods (disciplines) in the field of optimal programming. Concepts of economic model and economic-mathematical model. Classification of economic-mathematical models.	

2. General formulation of the mathematical programming problem. Scalar optimization problem and multicriteria decision making problem. Linear and nonlinear programming problems. Integer and bivalent programming problems. Specific examples of economic formulation of mathematical programming problems.
3. Linear programming concepts. Linear programming as part of mathematical programming. Basic concepts and properties of solving linear programming problems. Graphical and algebraic solution of the linear programming problem.
4. Methods for solving linear programming problems - classification: simplex method (primary and dual algorithm, revised algorithm), interior-point method. Algorithms and their complexity.
5. Simplex method - primary algorithm, primary algorithm using artificial variables.
6. Special cases in solving linear programming problems.
7. Theory of duality in linear programming problems. Economic interpretation of duality theory. Duality properties.
8. Dual simplex algorithm.
9. Sensitivity analysis and its economic interpretation.
10. Revised simplex algorithm.
11. Interior-point method.
12. Models with integer and bivalent variables and their economic interpretations. Cutting planes method for solving integer programming problems. Branch and bound method for solving integer programming problems.
13. Bivalent programming - explicit enumeration, Balas additive algorithm.

Support literature:

1. CHOCHOLATÁ, M. 2013. Lineárne programovanie pre manažérov. Bratislava: Vydavateľstvo EKONÓM.
2. WILLIAMS, H.P. 2013. Model Building in Mathematical Programming. London: John Wiley and Sons.
3. LAŠČIAK, A. a kol. 1990. Optimálne programovanie. 2. upravené vydanie. Bratislava: Alfa.

Syllabus:

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 618

A	B	C	D	E	FX
12.62	15.53	18.28	24.11	24.11	5.34

Lecturer: doc. Ing. Michaela Chocholatá, PhD., Ing. Pavel Gežík, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21232/22	**Title of course:** Optimal Programming II
Type, load and method of teaching activities: **Form of course:** Lecture / Practical **Recommended load of course (number of lessons):** **Per week:** 2 / 2 **Per course:** 26 / 26 **Method of study:** present	
Number of credits: 6	
Recommended semester/trimester of study: 2.	
Degree of study: II.	
Prerequisites:	
Requirements to complete the course: 40 % final paper and continuous testing 60 % final exam	
Student workload: Total study load (in hours): 6 credits x 26 hours = 156 hours Lectures participation: 26 hours Seminars participation: 26 hours Final paper preparation: 52 hours Preparation for the exam and continuous tests: 52 hours	
Teaching results: In particular, students acquire the following abilities: - to formulate nonlinear optimization models - to identify problems associated with solving nonlinear problems - to select algorithm for solving nonlinear programming problems. Students acquire in particular the following skills: - to model decision-making problems at the microeconomic and macroeconomic level on the basis of nonlinear optimization models. - to analyze of nonlinear problems, solution through Python software system. Students will acquire the following competencies: - practical skills and competencies with the application of optimization methods with nonlinear constraints, their analysis and solution using appropriate software (Python language)	
Indicative content: 1. Nonlinear optimization models in economic decision making, applications of nonlinear models 2. General formulation of nonlinear programming problems, classification of algorithms for solving such problems, complexity of algorithms 3. Software systems for solving nonlinear programming problems (Python and Gams language) 4. Convex analysis. 5. Optimality conditions in nonlinear programming problems, Kuhn-Tucker optimality conditions 6. Lagrange function and duality theory	

7. Methods for solving unconstrained problems, scalar function of one variable, scalar function of more than one variables, Python software system
8. Methods for solving constrained problems (Langrange's method, penalty and barrier functions)
9. Separable programming and fractional programming
10. Quadratic programming.
11. Methods for solving constrained problems, Python software system
12. Evolutionary algorithms, solving unconstrained problems
13. Evolutionary algorithms, solving constrained problems

Support literature:

Fendek, M.: Nelineárne optimalizačné modely a metódy, Ekonóm, Bratislava 1998
Alt, W.: Nichtlineare Optimierung. Eine Einführung in Theorie, Verfahren und Anwendungen. Vieweg Verlag. Berlin 2002.
Avriel, M.: Nonlinear Programming. Analysis and Methods. Doverr Publications. New York 2003
Bazaraa, M. - C. M. Shetty, C.M.: Nonlinear Programming: Theory and Algorithms. Wiley-Interscience. New York 2006
Bonnans, J. F. - Gilbert, J. C. – Lemarechal, C.: Numerical Optimization. Springer Verlag, Berlin 2003.

Syllabus:

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 6

A	B	C	D	E	FX
66.67	16.67	16.67	0.0	0.0	0.0

Lecturer: doc. Ing. Zuzana Čičková, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21371/22	**Title of course:** Quantitative Economics I
Type, load and method of teaching activities: **Form of course:** Lecture / Practical **Recommended load of course (number of lessons):** **Per week:** 2 / 2 **Per course:** 26 / 26 **Method of study:** present	
Number of credits: 6	
Recommended semester/trimester of study: 2.	
Degree of study: II.	
Prerequisites:	
Requirements to complete the course: 40 % assignments; 60 % final exam	
Student workload: 156 hours, Lectures participation: 26 hours, Seminar participation: 26 hours, Semester work: 42 hours Preparation for final exam: 62 hours	
Teaching results: The graduate of the course is able to explain various microeconomic phenomena with economic models. Abilities: - Students will be able to formulate, solve and interpret economic models describing known microeconomic phenomena and interactions. Skills: - Graduates will gain current knowledge of economic theory at the micro level – the firm theory, the consumer theory, the risk theory and the general equilibrium theory – and at the macro level – the real business cycle theory. Competencies: - Students will be able to formulate and express the economic theoretical background needed in microeconometric analyzes used in modern research, in forecasts made by scientific research institutions or in the financial sector. Students are able to explain the basic economic processes, the effects of various shocks and policies.	
Indicative content: 1. Basic economic terms and measurements 2. Production function forms and interpretations 3. Firm problem 4. Cost analysis 5. Behaviour of firms in different market structures 6. Utility function forms and interpretations, consumer problem 7. Income and substitution effects 8. Endowment economy model	

9. Financial rigidities
10. Risk theory
11. General equilibrium theory
12. Pareto’s efficiency and welfare theorems
13. Static real business cycle model

Support literature:
1. Doepke, M., Lehnert, A., Sellgren, A.W. Macroeconomics. http://faculty.wcas.northwestern.edu/~mdo738/book.htm (október 2019).
2. Wang, Susheng (2018). Microeconomic Theory. Singapore: Springer.
3. Williamson, S.D. (2018). Macroeconomics. Harlow: Pearson.

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 0

A	B	C	D	E	FX
0.0	0.0	0.0	0.0	0.0	0.0

Lecturer: doc. Ing. Karol Szomolányi, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KOVE FHI/ IIB21372/22	**Title of course:** Quantitative Economics II
Type, load and method of teaching activities: **Form of course:** Lecture / Practical **Recommended load of course (number of lessons):** **Per week:** 2 / 2 **Per course:** 26 / 26 **Method of study:** present	
Number of credits: 6	
Recommended semester/trimester of study: 3.	
Degree of study: II.	
Prerequisites:	
Requirements to complete the course: 40 % assignments; 60 % final exam	
Student workload: 156 hours Lectures participation: 26 hours, Seminar participation: 26 hours, Semester work: 42 hours Preparation for final exam: 62 hours	
Teaching results: The graduate of the course is able to explain various economic phenomena with economic models. Abilities: - Students will be able to formulate, solve and interpret economic models describing known conomic phenomena and interactions. Skills: - Graduates will gain current knowledge of economic theory – growth theory, business cycle theory, monetary theory, New Keynesian theory, inflation theory, new monetary theory based on model with banks. Competencies: - Students will be able to formulate and express the economic theoretical background needed in econometric analyzes used in modern research, in forecasts made by scientific research institutions or in the financial sector. Students are able to explain the basic economic processes, the effects of various shocks and policies.	
Indicative content: 1. Dynamic economic measures, economic growth, business cycles and inflation. 2. Growth theory. 3. Convergence and steady growth. 4. Search model. 5. Real business cycle model RBC. 6. Small open economy RBC model (SOE RBC). 7. Dynamic general equilibrium model (DGE). 8. Small open economy DGE model. 9. Flexible prices and wages in DGE models.	

10. Sticky prices and wages in DGE models.
11. Neo-Fischer effects in DGE models.
12. Banks in DGE models.
13. Applications of DGE models.

Support literature:

1. Barro, R.J. Macroeconomics – A Modern Approach. Thomson South Western, 2008.
2. Doepke, M., Lehnert, A., Sellgren, A.W. Macroeconomics. http://faculty.wcas.northwestern.edu/~mdo738/book.htm (október 2019).
3. Schmitt-Grohe, S., Uribe, M., Woodford, M. International Macroeconomics. http://www.columbia.edu/~mu2166/UIM/ (október 2019).
4. Williamson, S.D. (2018). Macroeconomics. Harlow: Pearson.

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 0

A	B	C	D	E	FX
0.0	0.0	0.0	0.0	0.0	0.0

Lecturer: doc. Ing. Karol Szomolányi, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KŠ FHI/IID22130/21	**Title of course:** Regression and Correlation Analysis

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 1.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
20 % assignments (2 assignments)
20 % semester project processed in SAS Enterprise Guide
60 % final exam (25% theoretical part, 35% practical part)

Student workload:
Total study load (in hours): 156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 26 hours
Preparation for assignments: 26 hours
Elaboration of semester project: 26 hours
Preparation for final exam: 26 hours

Teaching results:
After successful completion of this class, students will be able to analyze the relationships between statistical variables through multiple regression and correlation analysis.
In particular, students will acquire the following abilities:
− Students will acquire knowledge about the concepts, principles, methods and procedures used in multiple regression and correlation analysis.
− Students will acquire knowledge about the procedures and methods to verify assumptions of a random error term in a regression, about the consequences of violating these assumptions and about solving such problems.
− Students will understand the connection between regression analysis methods and correlation analysis methods.
−
Students will acquire in particular the following skills:
− Students will be able to perform calculations for the relevant statistical procedures, both by their own calculations (especially with the use of matrix calculus), as well as with the use of professional statistical software SAS.
− Students will learn to adequately apply the procedures and methods of regression and correlation analysis and correctly interpret the results.

− They will have the ability of critical thinking in distinguishing between causal and spurious relationship and in selecting of predictors.

Indicative content:
The course Regression and correlation analysis provides students with comprehensive knowledge and skills in the field of multiple regression analysis and correlation analysis, which are among the most commonly used statistical methods in the field of economics and management, both in practice and in research.

Support literature:
1. Šoltés, E. (2019). Regresná a korelačná analýza s aplikáciami v softvéri SAS. Bratislava: Letra Edu.
2. Šoltés, E. (2020). Regresná a korelačná analýza s aplikáciami v softvéri SAS – zbierka príkladov. Bratislava: Letra Edu.
3. SAS Institute Inc. (2017). The REG Procedure. In SAS/STAT®14.3 User's Guide. Cary, NC: SAS Institute Inc.
4. Wooldridge, J. M. (2013). Introductory Econometrics: A Modern Approach (5th ed.). Mason: South-Western.
5. Hebák, P., Hustopecký, J., Malá, I. (2005). Vícerozměrné statistické metody (2). Praha: Informatorium.
6. Darlington, R. B., Hayes, A. F. (2016). Regression Analysis and Linear Models: Concepts, Applications and Implementation. Guilford Publications.
7. Fox, J. (2015). Applied Regression Analysis and Generalized Linear Models. Sage Publications.
8. Belsley, D. A., Kuh, E., Welsh, R. E. (1980). Regression Diagnostics: Identifying Influential Data and Sources of Collinearity. New York: John Wiley & Sons, Inc.
9. MacKinnon, J. G. – White, H. (1985). Some Heteroskedasticity-Consistent Covariance Matrix Estimators with Improved Finite Sample Properties. Journal of econometrics, 29(3), 305-325.
Literature will be continuously updated with the latest scientific and professional titles.

Syllabus:
1. Introduction to multiple regression and correlation analysis. Classical linear regression model (CLRM). Ordinary least squares estimates.
2. Overall significance of a regression and an individual contribution of explanatory variables.
3. Statistical inference for parameters of CLRM. Predictions. Confidence interval for an individual prediction and confidence interval for the expected value (mean) of the dependent variable.
4. Correlation analysis. Simple correlation (including statistical inference).
5. Multiple, partial and semi-partial correlation (including statistical inference).
6. Collinearity diagnostics.
7. Model selection methods.
8. Influence diagnostics.
9. Graphical analysis of residuals. Assumption of homoskedasticity - its verification, consequences of its violation and solution of this problem.
10. Assumption of independence and assumption of normal distribution of error term - their verification, consequences of their violation and solution of these problems.
11. Generalized linear regression model.
12. Estimation of nonlinear regression models.
13. Summary.

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 230

A	B	C	D	E	FX
18.7	20.43	20.87	21.74	13.04	5.22

Lecturer: prof. Mgr. Erik Šoltés, PhD.

Date of the latest change: 07.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21991/22	**Title of course:** Seminar to Final Thesis I

Type, load and method of teaching activities:
Form of course: Lecture / Practical / Seminar
Recommended load of course (number of lessons):
Per week: 0 / 2 / 2 **Per course:** 0 / 26 / 26
Method of study: present

Number of credits: 2

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
individual work, written project-work of Final Thesis, credits

Student workload:
52 hours,
participation in seminars: 26 hours
processing prescribed tasks by the supervisor of Final Thesis: 26 hours

Teaching results:
By completing the Seminar to Final Thesis I is student able to:
- gather, process and interpret professional literature from selected field of study
- clarify/define research problems
- present creative procedures and solutions in the field of research problems

Indicative content:
- gathering and processing of basic professional literature in the field of final thesis research
- preparing the final thesis framework/structure – chapters and subchapters
- choosing the methods of processing the final thesis
- time arrangement of work schedule for each part of the final thesis

Support literature:
According to the specified final thesis theme

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 33

NZ	Z
0.0	100.0

Lecturer:
Date of the latest change: 21.02.2022
Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21992/22	**Title of course:** Seminar to Final Thesis II

Type, load and method of teaching activities:
Form of course: Lecture / Practical / Seminar
Recommended load of course (number of lessons):
Per week: 0 / 2 / 2 **Per course:** 0 / 26 / 26
Method of study: present

Number of credits: 2

Recommended semester/trimester of study: 4.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
individual work, written project-work of Final Thesis, credits

Student workload:
participation in seminars: 26 hours
processing prescribed tasks by the supervisor of Final Thesis: 26 hours

Teaching results:
By completing the Seminar to Final Thesis I is student able to:
- gather, process and interpret professional literature from selected field of study
- clarify/define research problems
- present creative procedures and solutions in the field of research problems

Indicative content:
- gathering and processing of basic professional literature in the field of final thesis research
- preparing the final thesis framework/structure – chapters and subchapters
- choosing the methods of processing the final thesis
- time arrangement of work schedule for each part of the final thesis

Support literature:
According to the specified final thesis theme

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 26

NZ	Z
0.0	100.0

Lecturer:

Date of the latest change: 21.02.2022
Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21550/22	**Title of course:** Simulation Modelling

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 5

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
40 % Assignments and Final project presentation;
60 % Final exam

Student workload:
Total study load (in hours): 130 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Elaboration of the final project: 52 hours
Preparation for final exam: 26 hours

Teaching results:
In particular, students will acquire the following abilities:
- knowledge of economic data analysis,
- knowledge of the construction of simulation models,
Students will acquire in particular the following skills:
- ability to construct and use simulation models,
- ability to gather and analyze data
- ability to use simulation software
- ability to formulate clear and convincing presentations of their work results in both written and oral form.
Students will acquire the following competencies:
- practical skills and competencies with the application of simulation methods in the analysis of economic problems in the field of waiting line theory and inventory theory using simulation software.

Indicative content:
1. Introduction to simulation modelling. Analytical and simulation models.
2. Monte Carlo methods. Problems solving using the Monte Carlo method.
3. Discrete event simulation
4. The concept of a random number. Pseudorandom numbers. Generation of random numbers. Congruence methods. Testing of generated random numbers.

5. Discrete and continuous probability distributions.
6. Analysis of simulation model input data.
7. Validation and verification of the simulation model.
8. Analysis of simulation model output data.
9. Simulation optimization and comparison of variants.
10. Simulation software overview.
11. Waiting line models simulation
12. Inventory problem simulation
13. Case studies

Support literature:

Domonkos, T.: Simulácie. Bratislava : Letra Edu, 2018. 80 s. ISBN 978-80-89962-01-3.
2. Dlouhý, M., Fábry, J., Kuncová, M., Hladík, T.: Simulace podnikových procesú. Brno: Computer Press, 2011. 206 s. ISBN 978-80-251-3449-8.
3. Banks, J., Carson Ii, S. J., Nelson, B. N., Nicol, D. M.: Discrete-event system simulation. New Jersey: Pearson Prentice Hall, 2005, 608 s. ISBN 0-13-144679-7.
4. Law, A. M.: Simulation Modeling and Ananlysis. New York: McGraw-Hill, 2014, 800 s. ISBN 0073401323

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 408

A	B	C	D	E	FX
22.55	25.0	23.53	13.73	15.2	0.0

Lecturer: doc. Ing. Marian Reiff, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21380/22	**Title of course:** Spatial Econometrics

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 5

Recommended semester/trimester of study: 3.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30 % work at seminars and writing of projects
70 % combined final exam

Student workload:
Total study load (in hours): 5 credits x 26 hours = 130 hours
26 hours lecture attendance
26 hours seminar attendance
26 hours preparation for seminars
26 hours writing a seminar paper
26 hours preparation for final exam

Teaching results:
Upon successful completion of the course, students will acquire the following knowledge:
- basic knowledge of a set of statistical and econometric techniques that allow to deal with the specifics caused by spatial aspects in regional data analysis.

Upon successful completion of the course, students will acquire the following skills:
- ability to use basic techniques of spatial data analysis and spatial econometrics,
- ability to use specialized econometric software, GeoDa and R software.

Upon successful completion of the course, students will acquire the following competencies:
- practical skills and competencies associated with the application of models and methods of spatial data analysis and spatial econometrics in the analysis of specific tasks using adequate software (GeoDa, R).

Indicative content:
1. Spatial data. Visualization of spatial data - graphs, maps.
2. Spatial effects. Spatial autocorrelation and heterogeneity. Construction of spatial weight matrix - contiguity weights, distance weights.
3. Spatial autocorrelation testing. Moran's I statistics, Geary's C statistics, Getis-Ord G statistics.
4. Global and local spatial statistics, LISA.
5. Bivariate and multivariate local spatial statistics.
6. Spatial econometric models. Spatial autocorrelation diagnostics in regression model. Classification of spatial econometric models.

7. Spatial Autoregressive Model (SAR) and Spatial Error Model (SEM). Spatial method of maximum likelihood.
8. Spatial Autoregressive Model (SAR) and Spatial Durbin Model (SDM). Spatial two-stage least squares method.
9. SARAR and SLX model. Interpretation of parameters in spatial econometric models.
10. Direct, indirect and total effects in spatial econometric models. Spatial decomposition of effects.
11. Spatial heterogeneity. Basic specifications of spatial regimes.
12. Spatial heterogeneity. Geographically weighted regression (GWR).
13. Kernel weights in GWR method. Mixed GWR method.

Support literature:

1. ANSELIN, L. – REY, S. J. 2014. Modern Spatial Econometrics in Practice. Chicago: GeoDa Press LLC, 2014. 354 p. ISBN 0986342106
2. ARBIA, G. 2014. A Primer for Spatial Econometrics. Berlin Heidelberg: Springer-Verlag, 2006. 207 p. ISBN-10 3-540-32304-X.
3. FOTHERINGHAM, A. S., BRUNSDON, C., CHARLTON, M. E. 2002. Geographically Weighted Regression. The Analysis of Spatial Varying Relationships. Chichester: Wiley.

Syllabus:

Language whose command is required to complete the course:

Notes:

Assessment of courses

Total number of evaluated students: 0

A	B	C	D	E	FX
0.0	0.0	0.0	0.0	0.0	0.0

Lecturer: doc. Ing. Andrea Furková, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava	
Faculty: Faculty of Economic Informatics	
Course code: KŠ FHI/IID22240/21	**Title of course:** Statistical Inference

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
30 % assignments (2 assignments)
70 % final exam (35% theoretical part, 35% practical – examples solution)

Student workload:
Total study load (in hours): 156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 26 hours
Preparation for assignments: 26 hours
Final exam preparation: 52 hours

Teaching results:
At the end of the semester, students will have a good overview of inference methods used in statistics, more specifically:
In particular, students acquire the following abilities:
- Students will acquire knowledge about the principles of individual methods as well as about the contents between different methods so that they can be properly decided in the real situation. They will be able to interpret the methods results correctly.
Students acquire in particular the following skills:
- Students will be able to apply methods of statistical inference in appropriate situations and verify the assumptions of their use
Students will acquire the following competencies:
- Students will be able to realize a qualified analysis of data from the selection survey, creatively approaching the absent prerequisite for some methods, qualified to interpret the results in the necessary contexts

Indicative content:
The course provides comprehensive knowledge of the theoretical principle, assumptions and procedures for inference methods so that students will adequately use them in practice. In addition to points and interval estimates, a great emphasis is given on testing hypotheses that are part of various statistical procedures (mainly for verification of assumptions and to verify statistical significance).

The course deals also with non-parametric tests that may be widely used if the assumptions of numeric variables distribution are not met.

Support literature:

1. Kotlebová a kol. (2015). Štatistická indukcia v príkladoch. Bratislava: Ekonóm.
2. Malá, I. (2013). Statistické úsudky. Praha: Professional Publishing.
3. Garthwaite, P. H., Jolliffe, I. T. (1995). Statistical Inference. Prentice-Hall International, Inc.
4. Anderson, D. R., Sweeney, D. J., Williams, T. A., Camm, J. D., Cochran, J. J. (2016). Statistics for business and economics. Nelson Education.
5. Pacáková, V. a kol. (2012). Štatistická indukcia pre ekonómov (1. vyd.). Bratislava: Ekonóm.
6. Pacáková, V. a kol. (2015). Štatistické indukcia pre ekonómov a manažérov. Bratislava: Wolters Kluwer.
7. Liu, H. (2015). Comparing Welch ANOVA, a Kruskal-Wallis test, and traditional ANOVA in case of heterogeneity of variance. Richmond, Virginia: Virginia Commonwealth University.
8. Blatná, D. (1996). Neparametrické metody. Praha: VŠE.

Literature will be continuously updated with the latest scientific and professional titles.

Syllabus:

1. Introduction: Random variable – basic concepts, properties and characteristics.
2. Discrete and continuous random variables.
3. Point estimation of the population parameters – principle and methods of the point estimation.
4. Interval estimation of the population parameters.
5. Hypothesis testing.
6. Inference conclusions of two populations parameters.
7. Analysis of variance.
8. Analysis of categorical data independency.
9. Goodness of fit-tests.
10. Nonparametric tests – the principle, comparing with parametric tests, randomity tests, tests of population parameters.
11. Nonparametric tests comparing two populations.
12. Nonparametric tests comparing more than two populations.
13. Summary.

Language whose command is required to complete the course:

Slovak

Notes:

Assessment of courses

Total number of evaluated students: 32

A	B	C	D	E	FX
9.38	18.75	28.13	25.0	18.75	0.0

Lecturer: RNDr. Eva Kotlebová, PhD.

Date of the latest change: 07.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KŠ FHI/IID22200/21	**Title of course:** Time Series Analysis

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
Preliminary Assessment:
− Test and activity in seminars (15 %),
− Individual assignments – project (25 %)
Final Assessment - written exam (60 %):
30% theoretical part,
30% practical – examples solution.

Student workload:
Total study load (in hours): 156 hours
Distribution of study load
Lectures participation: 26 hours
Seminar participation: 26 hours
Preparation for seminars: 26 hours
Preparation for assignments: 26 hours
Elaboration of Semester project: 26 hours
Preparation for final exam: 26 hours

Teaching results:
Upon successful completion of the course, students will gain a theoretical and practical basis for various statistical methods of social and economic time series modelling and the construction of short-term statistical forecasts with the support of statistical software.
They will be able to make a statistical analysis of the real time series of economic indicators, to propose a suitable time series model, perform a statistical verification, justify the model and interpret the results of the statistical software outputs. Students will be able to determine ex-post statistical forecasts and verify the prognostic quality of the models and construct short-term ex-ante forecasts.
The course Time series analysis provides comprehensive knowledge of the theoretical principles, assumptions and procedures for time series analysis so that students will receive appropriate skills to be able to adequately use classical decomposition, adaptive techniques (random walk model, moving average techniques, exponential smoothing and forecasting models) and basics of application of the Box-Jenkinson methodology in the field of economics and management, both in practice and in research.

At the end of the semester, students will have a good overview of methods of time series analysis, more specifically:
students will acquire the following knowledge:
- About basic concepts, principles, methodological approaches and techniques of time series analysis such as a realisation of stochastic processes.
- About procedures and methods for modelling of the trend of time series, construction of forecasts (based on the trend-regression functions, naïve model, exponential smoothing - Brown models, Holt model).
- About principles and techniques of the Box-Jenkins methodology for modelling stochastic linear processes by ARIMA models,
- Understanding the modelling of trend and seasonality of time series by classical decomposition, and Holt-Winters model.
- On the basic concepts of Box-Jenkins methodology they will understand the construction of autoregressive models of linear stochastic processes with the construction of ex-ante forecasts using seasonal ARIMA (p, d, q) (P, D, Q)s models.
Students will acquire in particular the following skills:
- Students will be able to perform calculations for the statistical procedures with the use of professional analytical and statistical software.
- They will learn the practical steps of the analysis of social and economic time series and the construction of short-term forecasts by the most appropriate from models with use of classical, adaptive techniques and the technics of Box-Jenkins methodology.
- Students will learn to adequately apply the appropriate methodology of modelling real financial time series, they will acquire the skills to present and interpret the results of its application.
Students will acquire the following competencies:
- Students will be able to use the knowledge and skills appropriately as a tool for decision-making and solving practical tasks from economic practice.

Indicative content:
The course Time Series Analysis provides students with knowledge and skills in the field of statistical analysis of one-dimensional time series of socio-economic variables, which are among the most commonly used statistical methods in economics and management, both in practice and in research. Students will use the knowledge gained in this course in related subjects (Econometrics, …), in the elaboration of final theses, as well as in follow-up research and practice.

Support literature:
1. Rublíková, E. – Artl, J. – Arltová, M. – Libičová, L. (2007). Analýza časových radov – Zbierka príkladov. EKONÓM 2003, Bratislava, s.188. ISBN 80-225-1748-8.
2. Rublíková, E., 2007. Analýza časových radov. IURA Edition, Bratislava , s. 207. ISBN 978-80-8078-139-2.
3. Rublíková, E. – Lubyová, M. (2016). Analýza časových radov 1 : praktikum. 1. EKONÓM, Bratislava, s.171. ISBN 978-80-225-4341-5.
4. Artl, J. – Artlová, M. – Rublíková, E. (2002). Analýza ekonomických časových řad s příklady. Praha VŠE. Dostupné on line: http://nb.vse.cz/~arltova/vyuka/crsbir02.pdf
5. Arlt, J. – Arltová, M.: Ekonomické časové řady. Professional Publishing. Praha. 1. vyd. 2009. ISBN 978-80-86946-85-6.
6. Cipra, T. (2013). Finanční ekonometrie. Ekopress, Praha, 2.vyd.
7. Cipra, T. (1986). Analýza časových řad s aplikacemi v ekonomii. Praha: SNTL. 248 s.
8. Brockwell, P. J. – Davis, R. A.: Introduction to Time Series and Forecasting. Springer Texts in Statistics. Third Edition. Springer International Publishing Switzerland. 1996, 2002, 2016. ISSN 1431-875X ISSN 2197-4136 (electronic), ISBN 978-3-319-29852-8, ISBN 978-3-319-29854-2 (eBook). DOI 10.1007/978-3-319-29854-2.

9. Bisgaard, S. – Kulahci, M. (2011). Time Series Analysis and Forecasting by Example. Series: Wiley series in probability and statistics. Kindle Edition. 400 p. ISBN-13: 978-0470540640; ISBN-10: 0470540648.
10. Robert F. Engle v osobnom rozhovore k výučbe odporučil učebné texty:
11. Hamilton, J. D. (1994). Time Series Analysis 1st Edition. Princeton University Press. 1994
12. Wooldridge, J. M. (2015). Introductory Econometrics: A Modern Approach (Upper Level Economics Titles).
13. Watson, M. W. – Stock, J. (2014). Introduction to Econometrics, Third Updated Edition, Addison-Wesley. ISBN-13: 978-1292071312, ISBN-10: 1292071311.
Literature will be continuously updated with the accessible latest scientific and professional titles.

Syllabus:

1. Overview of methods of the course Time series analysis, conditions for completing the course. Objectives of the analysis of socio-economic time series, as realization of stochastic process, its properties, stationarity (weak, strong, Gaussian). Graphic methods of analysis of time series components (methods of extracting stochastic or analytical trend from time series; classical decomposition - mechanical smoothing and extracting from the components).
2. Random process and its moments. Stationary random process and its properties. Stationary time series and their extrapolations (naive forecasts, constant trend, terminal moving averages as forecast techniques). Stationarity tests. ACF and PACF of a random processes. Transformations of nonstationary series to stationary (differentiation, notation using the backward operator; Box – Cox transformation).
3. Trends in the time series (linear, quadratic, exponential, hyperbolic, Gomperz curve) and t-tests of their parameters in a statistical software application. Estimation of the random component and its variance. Average errors of model residuals, definition, interpretation (MSE, RMSE, ME, MAE, MAPE, MPE) and comparison of systematic bias of models according to software outputs.
4. Analysis of residuals. White noise and its properties (independence, homoscedasticity, normality). Results of graphical and numerical tests (nonparametric tests of independence in the time series application). Histogram, Box-Plot, normal probability plot in time series application – interpretation of the results.
5. Tests of non-correlation. Sample ACF and sample PACF (Bartlett test, empirical rule). Postmenteau tests (Box-Pierce, Ljung-Box). Their applications for time series and for the random component of models.
6. Partition into estimation and validation/verification period. Ex-post and ex-ante extrapolations. Comparison of model quality (interpolation and extrapolation period). Evaluation of the errors of extrapolation. Assessment of model suitability, including of information criteria for model selectin (AIC, BIC, Theil's U, Adjusted coefficient of determination).
7. Exponential smoothing and forecasting - Brown models. Holt model of exponential smoothing.
8. Autoregressive models of stationary process AR (p). Models of moving averages of stationary process MA (q). Properties of ACF and PACF of these processes. Random walk process - AR (1) process with unit root.
9. Models of stationary ARMA processes (p,q) and properties of their ACF and PACF. Integrated ARIMA models (p,d,q) and their properties. Preliminary determination of the number of parameters, verification of the initial assumptions of the models. Forecasting of non-seasonal time series by ARIMA models - applications.
10. Time series with seasonal component. Seasonal decomposition. Seasonal indices and seasonally adjusted time series. Extrapolation of seasonally adjusted series. Extrapolation of time series with seasonality. A combination of classical and adaptive forecasting methods. Holt-Winter model of exponential smoothing.
11. ARIMA models with seasonal component.

12. Practical advice and summary of the steps of the Box-Jenkins methodology in the phases of identification, estimation and verification. Verification of the accuracy of short-term forecasts.
13. Presentation of the results of an illustrative application of the studied curriculum - a case study on a real financial time series. Repetition and discussion of the subject problems

Language whose command is required to complete the course:
Slovak

Notes:

Assessment of courses
Total number of evaluated students: 11

A	B	C	D	E	FX
0.0	63.64	27.27	9.09	0.0	0.0

Lecturer: Ing. Silvia Komara, PhD.

Date of the latest change: 30.03.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.

DESCRIPTION OF COURSE

University: University of Economics in Bratislava

Faculty: Faculty of Economic Informatics

Course code: KOVE FHI/ IIB21340/22	**Title of course:** Time Series Econometrics

Type, load and method of teaching activities:
Form of course: Lecture / Practical
Recommended load of course (number of lessons):
Per week: 2 / 2 **Per course:** 26 / 26
Method of study: present

Number of credits: 6

Recommended semester/trimester of study: 2.

Degree of study: II.

Prerequisites:

Requirements to complete the course:
individual work and continuous tests 20%
project for the final exam 40%
final exam 40%

Student workload:
student workload: 156 h, participation in lectures 26 h, participation in seminars 26 h, elaboration of a semester project 62 h, preparation for the final exam 42 h

Teaching results:
Upon successful completion of this course, students will have knowledge of currently used methods of time series econometrics and should be able to use econometric techniques and procedures for standard time series (not high frequency data).
Students will gain practical skills and competencies with the application of advanced econometric methods in the analysis of economic problems of time series using software R and Python.

Indicative content:
1. Dynamic single-equation models.
2. Impulse response function.
3. Stochastic processes and trend in processes.
4. Stationarity and testing of stationarity.
5. Cointegration in single-equation model, ECM, Engle-Granger, Bounds tests.
6. Vector autoregressive models and their estimation.
7. Testing and identification of vector autoregressive models
8. Structural vector autoregressive models - Choleski decomposition.
9. Structural vector autoregressive models - different methods of identification.
10. Vector cointegration models, VECM.
11. Structural vector cointegration models.
12. Dynamic state-space models.
13. Kalman filter and estimation of state-space models.

Support literature:
1. Kleiber, C., Zeileis, A.: Applied Econometrics with R. Springer, 2008.

2. Pfaff, B.: Analysis of Integrated and Cointegrated Time Series with R, 2nd Edition. Springer-Verlag, 2008.
3. Neusser, K.: Time Series Econometrics. Springer-Verlag, 2016.
4. Enders, W.: Applied Econometric Time Series, Second edition. John Wiley and Sons, 2004.
5. Lütkepohl, H., Krätzig, M.: Applied Time Series Econometrics. New York: Cambridge University Press, 2005.
6. Lütkepohl, H.: New Introduction to Multiple Time Series Analysis. Berlin: Springer Verlag, 2005.

Syllabus:

Language whose command is required to complete the course:
Slovak, English

Notes:

Assessment of courses
Total number of evaluated students: 0

A	B	C	D	E	FX
0.0	0.0	0.0	0.0	0.0	0.0

Lecturer: prof. Ing. Martin Lukáčik, PhD.

Date of the latest change: 21.02.2022

Approved by: Person responsible for the delivery, development and quality of the study programme prof. Mgr. Erik Šoltés, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Michaela Chocholatá, PhD., Person responsible for the delivery, development and quality of the study programme prof. Mgr. Juraj Pekár, PhD., Person responsible for the delivery, development and quality of the study programme prof. Ing. Martin Lukáčik, PhD., Person responsible for the delivery, development and quality of the study programme doc. Ing. Mária Vojtková, PhD.