SYLLABUS

Business forecasting and predictive modelling

University year 2025 - 2026

1. Information regarding the programme

1.1. Higher education institution	Babeş-Bolyai University
1.2. Faculty	Mathematics and Computer Science
1.3. Department	Computer Science
1.4. Field of study	Computer Science
1.5. Study cycle	Master
1.6. Study programme/Qualification	Cyber Security
1.7. Form of education	Full time

2. Information regarding the discipline

2.1. Name of the discipline	**Business forecasting and predictive modelling**					Discipline code	**MME8210**
2.2. Course coordinator					Lect. PhD. Oneț-Marian Zsuzsanna		
2.3. Seminar coordinator					Lect. PhD. Oneț-Marian Zsuzsanna		
2.4. Year of study	1	2.5. Semester	1	2.6. Type of evaluation	E	2.7. Discipline regime	Optional

3. Total estimated time (hours/semester of didactic activities)

3.1. Hours per week	**4**	of which: 3.2 course	**2**	3.3 seminar/laboratory/project	**1S + 1P**
3.4. Total hours in the curriculum	56	of which: 3.5 course	28	3.6 seminar/laboratory/project	**28**
Time allotment for individual study (ID) and self-study activities (SA)					**hours**
Learning using manual, course support, bibliography, course notes (SA)					20
Additional documentation (in libraries, on electronic platforms, field documentation)					20
Preparation for seminars/labs, homework, papers, portfolios and					20
Tutorship					4
Evaluations					5
Other activities:					
3.7. Total individual study hours	**69**				
3.8. Total hours per semester	**125**				
3.9. Number of ECTS credits	**5**				

4. Prerequisites (if necessary)

4.1. curriculum	Algorithmics, data structures, statistics
4.2. competencies	Ability to use data analytics computer software

5. Conditions (if necessary)

5.1. for the course	• Students will attend the course with their mobile phones silenced • A room with a good video projector is needed
5.2. for the seminar /lab activities	• Students will attend the seminar with their mobile phones silenced

6.1. Specific competencies acquired [1]

[1] One can choose either competences or learning outcomes, or both. If only one option is chosen, the row related to the other option will be deleted, and the kept one will be numbered 6.

Professional/essential competencies	• Demonstrate advanced skills to analysis, design, and construction of secure software systems, using a wide range of hardware / software platforms, programming languages and environments, and modeling, verification and validation tools
Transversal competencies	• Professional communication skills; concise and precise description, both oral and written, of professional results • Applying the norms of organized and efficient work, responsibility and reliability of the work performed both individually and within a team

6.2. Learning outcomes

Knowledge	The student knows: • The student/graduate develops the ability to translate academic knowledge into a professional, economic, social and ethical context • The student/graduate develops and promotes effective work strategies and practices, exemplary professional style and conduct, respecting the values and principles of professional ethics and deontology
Skills	The student is able to: • The student/graduate is able to coordinate project management activities, using decision-making skills, critical and innovative thinking, as well as digital skills
Responsibility and autonomy:	The student has the ability to work independently to obtain: • The student/graduate assumes responsibility for the product of his / her work, requests feedback and uses it constructively • The student/graduate uses efficient strategies, methods and techniques for lifelong education, in order to self educate and self develop his/her personal and professional skills

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• To introduce the student in forecasting and predictive modelling
7.2 Specific objective of the discipline	• To present the field of forecasting and predictive modelling as a novel research and application domain. • To induce the necessity of forecasting and predictive modelling methods by studying relevant practical applications • To offer the student the instruments that will allow to develop different forecasting applications.

8. Content

8.1 Course	Teaching methods	Remarks

1. Administration and organization. What is forecasting? Introduction into time series. Types and examples of time series.		
2. Introduction into programming in R • Data representation in R • Data visualization in R		
3. Time series visualization • Time series plot (identifying trend, season and cycle using the plot. Stationary time series) • Seasonal plot • Seasonal subseries plot • Scatter plot • Lag plot • Autocorrelation plots. White noise		
4. Time series transformations Time series decomposition • Moving averages. Moving median • Additive and multiplicative decomposition • Classical decomposition, STL, SEATS, X-11 Stationarity: • Stationary time series. • The KPSS and ADF tests • Differencing		
5. The forecasting workflow • Simple forecasting methods • Fitted values and residuals • Residual diagnostics • Forecasting with decomposition • Performance measures (MAE, RMSE, MAPE, etc.)	• Interactive exposure • Explanation • Conversation • Didactical demonstration	
6. Time series regression models • Simple linear regression • Multiple linear regression • Evaluating the regression model • Dummy variables		
7. Exponential smoothing • Simple exponential smoothing • Holt's linear trend method • Damped trend models • Holt-Winters' method		
8. Forecasting with ARIMA models • Non-seasonal ARIMA • Seasonal ARIMA		
9. Multiple regression and forecasting		
10. Advanced methods • Prophet • Vector autoregression		
11. Machine Learning-based methods • Neural network models • Bootstrapping and bagging		
12. Deep Learning-based methods • Recurrent Neural netwrok based models • Transformer-based models		
13. Invited Lecture – SAS		The date of this lecture might be

		changed, depending on the schedule of the invited lecturer.
14. Recap		

Bibliography

1. R.J. Hyndman, G. Athanasopoulos Forecasting: Principles and Practice, OTexts, 3rd edition, 2018.
2. P.J. Brockwell, R.A. Davis, Introduction to Time Series and Forecasting, Springer Verlag, 2nd edition, 2002.
3. D.C. Montgomery, C.L. Jennings, M. Kulahci, Introduction to Time Series Analysis and Forecasting, Wiley, 2nd edition, 2015.
4. M. Huber, D. Modlin, C. Wells. Forecasting Using Model Studio in SAS Viya, 2020
5. V. Zoonekynd, Statistics with R, 2007
6. C. Kuo, Modern Time Series Forecasting Techniques For Predictive Analitics and Anomaly Detection, Innovation Press, 2024

8.2 Seminar / laboratory	Teaching methods	Remarks
		The seminar of organized as 2 hour classes once in every two weeks.
1. Seminar organization. Selection of time series data sets	• Interactive exposure • Explanation • Conversation • Exercise	
2. Time series visualization		
3. Time series decomposition		
4. Exponential smoothing		
5. ARIMA models		
6. Regression-based forecasting		
7. ML/DL-based forecasting		

Bibliography

1. R.J. Hyndman, G. Athanasopoulos Forecasting: Principles and Practice, OTexts, 3rd edition, 2018.
2. P.J. Brockwell, R.A. Davis, Introduction to Time Series and Forecasting, Springer Verlag, 2nd edition, 2002.
3. D.C. Montgomery, C.L. Jennings, M. Kulahci, Introduction to Time Series Analysis and Forecasting, Wiley, 2nd edition, 2015.
4. M. Huber, D. Modlin, C. Wells. Forecasting Using Model Studio in SAS Viya, 2020
5. V. Zoonekynd, Statistics with R, 2007
6. C. Kuo, Modern Time Series Forecasting Techniques For Predictive Analitics and Anomaly Detection, Innovation Press, 2024

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The content of the discipline is consistent with the similar disciplines from other Romanian universities and universities from abroad, as well as with the requirements that potential employers would have in the forecasting and predictive modelling field.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	The correctness and completeness of the accumulated knowledge	Written exam (in the exam session)	50%
10.5 Seminar	The correctness and completeness of the solutions for the	Assignments, which will cover the discussed topics for forecasting. For every	50%

	assignment. Respecting deadlines for the assignments.	assignment, the students will need to apply some analysis/forecasting methods for different time series data sets. Seminar grade is the average of the grades received for the assignments.	

10.6 Minimum standard of performance

Students have to prove that they acquired an acceptable level of knowledge and understanding of the forecasting and predictive modelling domain, that they are capable of stating this knowledge in a coherent form, that they have the ability to establish certain connections and to use the knowledge in solving different problems.

Class attendance is neither formally required nor observed.

Successful passing of the exam is conditioned by:

- The final grade that has to be at least 5
- The written exam grade has to be at least 5
- Turning in at least 2 out of the 7 seminar assignments.

For the seminar assignments, penalty points are awarded for late turn-ins.

11. Labels ODD (Sustainable Development Goals)[2]

Not applicable.

Date:
15.04.2025

Signature of course coordinator

Lect. PhD. Zsuzsanna ONEȚ-MARIAN

Signature of seminar coordinator

Lect. PhD. Zsuzsanna ONEȚ-MARIAN

Date of approval:
...

Signature of the head of department

Assoc.prof.phd. Adrian STERCA

[2] Keep only the labels that, according to the *Procedure for applying ODD labels in the academic process*, suit the discipline and delete the others, including the general one for *Sustainable Development* – if not applicable. If no label describes the discipline, delete them all and write „*Not applicable*.”.