SYLLABUS

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	Data Science for Industry and Society
1.7. Form of education	Full time

2. Information regarding the discipline

2.1. Name of the discipline	**Forecasting and predictive modelling**					Discipline code	**MME8187**
2.2. Course coordinator					Lect. PhD. Oneț-Marian Zsuzsanna		
2.3. Seminar coordinator					Lect. PhD. Oneț-Marian Zsuzsanna		
2.4. Year of study	2	2.5. Semester	3	2.6. Type of evaluation	C	2.7. Discipline regime	Compulsory

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)					40
Additional documentation (in libraries, on electronic platforms, field documentation)					42
Preparation for seminars/labs, homework, papers, portfolios and					50
Tutorship					4
Evaluations					8
Other activities:					
3.7. Total individual study hours	**144**				
3.8. Total hours per semester	**200**				
3.9. Number of ECTS credits	**8**				

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	• Understanding and working with basic concepts in data analysis • Assimilation of mathematical concepts and formal models to understand, verify and validate decision support systems • Capability of information analysis and synthesis
Transversal competencies	• Professional communication skills; concise and precise description, both oral and written, of professional results , negociation abilities • Good English communication skills

6.2. Learning outcomes

Knowledge	The student knows: • Collection, representation, analysis and visualization of data from various fields (eg economics, finance, biology, natural sciences) • Use specific techniques and methods of visual representation and interaction, such as histograms, diffusion diagrams, surface graphs, tree maps and parallel coordinate plots, which can be used to present abstract numerical and non-numerical data, to reinforce understanding of this information by people.
Skills	The student is able to: • Navigation throughout the process: from the acquisition of information to the final product • Management of data science projects involving real-world information • Presentation of the results of the analyzes performed by elaboration of dissemination or presentation documents to report the results of a research and analysis project carried out, indicating the analysis procedures and methods that led to those results, as well as possible interpretations of the results. • Visual presentation of data, such as graphs or diagrams, to facilitate their understanding and exploitation
Responsibility and autonomy:	The student has the ability to work independently to obtain: • Applying scientific and analytical methods of data analysis to solve problems in different fields, developing creative thinking about data and making decisions • Providing reproducible data analysis

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

<table>
<tr><td>8.1 Course</td><td>Teaching methods</td><td>Remarks</td></tr>
<tr><td>Administration and organization. Introduction into time series.</td><td rowspan="14">• Interactive exposure
• Explanation
• Conversation
• Didactical demonstration</td><td></td></tr>
<tr><td>Introduction into programming in R</td><td></td></tr>
<tr><td>Time series visualization</td><td></td></tr>
<tr><td>Time series decomposition</td><td></td></tr>
<tr><td>Exponential smoothing</td><td></td></tr>
<tr><td>Exponential smoothing II</td><td></td></tr>
<tr><td>Forecasting with ARIMA models</td><td></td></tr>
<tr><td>Forecasting with ARIMA models II</td><td></td></tr>
<tr><td>Multiple regression and forecasting</td><td></td></tr>
<tr><td>Advanced methods</td><td></td></tr>
<tr><td>ML-based methods</td><td></td></tr>
<tr><td>Theoretical report presentation</td><td></td></tr>
<tr><td>Theoretical report presentation II</td><td></td></tr>
<tr><td>Written exam</td><td></td></tr>
<tr><td colspan="3">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</td></tr>
<tr><td>8.2 Seminar / laboratory</td><td>Teaching methods</td><td>Remarks</td></tr>
<tr><td></td><td></td><td>The seminar of organized as 2 hour classes once in every two weeks.</td></tr>
<tr><td>1. Seminar organization. Selection of time series data sets</td><td rowspan="7">• Interactive exposure
• Explanation
• Conversation
• Exercise</td><td></td></tr>
<tr><td>2. Time series visualization</td><td></td></tr>
<tr><td>3. Time series decomposition</td><td></td></tr>
<tr><td>4. Exponential smoothing</td><td></td></tr>
<tr><td>5. ARIMA models</td><td></td></tr>
<tr><td>6. Regression-based forecasting</td><td></td></tr>
<tr><td>7. ML-based forecasting</td><td></td></tr>
<tr><td colspan="3">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.
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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 week 14, during the last lecture)	40%
	A state-of-the-art research report on a relevant topic, based on recent research papers, should be prepared and presented	Evaluation of the research report (theoretical report) – a written paper based on at least 2 recent papers and an oral presentation	30%
10.5 Seminar	The correctness and completeness of the solutions for the assignment. Respecting deadlines for the assignments.	Assignments, which will cover the discussed topics for forecasting. For every 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.	30%

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 4 out of the 7 seminar assignments.

For the theoretical report, penalty points are awarded for delays in submission of proposed topic choice and submission of final reports. For the seminar assignments, penalty points are awarded for late turn-ins.

The report cannot be submitted or presented in the retake session.

If at least 4 seminar assignments were submitted during the semester, but their average grade is so low, that a passing grade cannot be achieved (not even with a perfect written exam), seminar assignments can be submitted for the retake exam, up to a maximum average grade of 5 for the seminar.

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*.”.