SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University of Cluj-Napoca**
1.2 Faculty	**Faculty of Mathematics and Computer Science**
1.3 Department	**Doctoral School in Mathematics and Computer Science**
1.4 Field of study	**Mathematics**
1.5 Study cycle	**Doctoral studies**
1.6 Study programme	**TRAINING PROGRAM BASED ON ADVANCED ACADEMIC STUDIES**

2. Information regarding the discipline

2.1 Name of the discipline		***Special topics on approximation of functions***					
2.2 Course coordinator		**Prof. dr. Octavian Agratini**					
2.3 Seminar coordinator		**Prof. dr. Octavian Agratini**					
2.4. Year of study	**1**	2.5 Semester	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**DS / Optional**

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

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar	1st sem.
3.4 Total hours in the curriculum	36	Of which: 3.5 course	24	3.6 seminar/laboratory	12
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					48
Additional documentation (in libraries, on electronic platforms, field documentation)					48
Preparation for seminars/labs, homework, papers, portfolios and essays					36
Tutorship					36
Evaluations					46
Other activities:					--
3.7 Total individual study hours	214				
3.8 Total hours per semester	250				
3.9 Number of ECTS credits	10				

4. Prerequisites (if necessary)

4.1. curriculum	Mathematical Analysis Functional Analysis
4.2. competencies	Comparative evaluation of the effectiveness of various methods of proofs

5. Conditions (if necessary)

5.1. for the course	-----
5.2. for the seminar /lab activities	-----

6. Specific competencies acquired

Professional competencies	• ability to perform the approximation of signals in various spaces functions • ability to operate with abstract concepts • ability to solve mathematical problems based on learned concepts
Transversal competencies	• abstract thinking • ability to apply mathematics in other scientific fields • ability to perform research

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

7.1 General objective of the discipline	Study of important knowledge on Approximation of Functions
7.2 Specific objective of the discipline	Acquiring specific working techniques from Approximation Processes

8. Content

8.1 Course	Teaching methods	Remarks
1. Spaces of functions. Properties	Exposition, proof, individual study	
2. Linear and positive approximation operators. Properties	Exposition, proof, examples	
3. Korovkin sets	Exposition, proof, individual study	
4. Moduli of smoothness and error of evaluation	Exposition, proof, individual study	
5. Approximations in weighted spaces	Exposition, proof, individual study	
6. Statistical convergence	Exposition, proof, examples	
7. Fourier transform of integrable functions	Exposition, proof, individual study	
8. Fourier transform with sliding window	Exposition, proof, examples	
9. Wavelets - preliminaries	Exposition, proof, examples	
10. Multiple resolution analysis	Exposition, proof, individual study	
11. Father wavelet function. Properties	Exposition, proof, examples	
12. Mother wavelet function. Properties	Exposition, proof, individual study	
8.2 Seminar	Teaching methods	Remarks
1. Bernstein operators. Properties	Explanation, examples	
2. Examples of approximation processes	Explanation, individual study	
3. Generalizations of Korovkin's theorems	Explanation, examples	
4. Convergence rate evaluation. Exercises	Explanation, examples	
5. Weighted functions. Korovkin type theorems	Explanation, examples	
6. Statistical convergence of sequences of linear and positive operators. Examples	Explanation, individual study	

7. Exercises: Fourier transforms	Explanation, examples	
8. Examples of window functions. Calculating the center and radius of a window	Explanation, individual study	
9. Properties of B-spline functions	Explanation, examples	
10. Two scale equation. Solutions	Explanation, examples	
11. Examples of father wavelets	Explanation, individual study	
12. Reconstruction of the signals by using wavelets	Explanation, individual study	

Bibliography

[1] Agratini, O., Blaga, P., Coman, Gh., *Lectures on Wavelets, Numerical Methods and Statistics*, Casa Cărții de Știință, Cluj-Napoca, 2005.

[2] Altomare F., Campiti, M., *Korovkin-type Approximation Theory and its Applications,* de Gruyter Series Studies in Mathematics, Vol. 17, Walter de Gruyter & Co., Berlin, New York, 1994.

[3] Lokenath Debnath, *Wavelet Transforms & Their Applications*, Birkhauser, Boston, 2002.

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

Content of the discipline is directed towards theory and applications. This topic is present in many doctoral programs of other universities.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Using basic concepts, examples	Test, project	25%
10.5 Seminar	Problem solving	Presentation, assignments	75%
10.6 Minimum performance standards			
Grade 5.			

Date	Signature of course coordinator	Signature of seminar coordinator
30.06.2021	Prof. dr. Octavian Agratini	Prof. dr. Octavian Agratini

Date of approval

07.07.2021

Signature of the head of doctoral school

Prof. dr. Gabriela Czibula