SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş-Bolyai University
1.2 Faculty	Faculty of Mathematics and Computer Science
1.3 Department	Department of Mathematics
1.4 Field of study	Mathematics
1.5 Study cycle	Master
1.6 Study programme / Qualification	Master of Advanced Mathematics

2. Information regarding the discipline

2.1 Name of the discipline	*Approximation techniques of the functions*					
2.2 Course coordinator	Professor Agratini Octavian, PhD					
2.3 Seminar coordinator	Professor Agratini Octavian, PhD					
2.4. Year of study	1	2.5 Semester	2	2.6. Type of evaluation	E	2.7 Type of discipline	Compulsory

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

3.1 Hours per week	3	Of which: 3.2 course	2	3.3 seminar	1
3.4 Total hours in the curriculum	42	Of which: 3.5 course	28	3.6 seminar	14
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					40
Additional documentation (in libraries, on electronic platforms, field documentation)					44
Preparation for seminars/labs, homework, papers, portfolios and essays					50
Tutorship					10
Evaluations					14
Other activities:					--

3.7 Total individual study hours	158
3.8 Total hours per semester	200
3.9 Number of ECTS credits	8

4. Prerequisites (if necessary)

4.1. curriculum	Mathematical Analysis Special Topics in Numerical Analysis
4.2. competencies	Comparative assessment and efficient use of various methods of demonstration

5. Conditions (if necessary)

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

6. Specific competencies acquired

Professional competencies	• The ability to understand and manipulate concepts, results and theories advanced in mathematics • Ability to use the knowledge gained and complementary in achieving a PhD in Mathematics
Transversal competencies	• Ability to self-improvement and to train continuously

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

7.1 General objective of the discipline	Assimilation of modern techniques of approximation of functions / signals
7.2 Specific objective of the discipline	• Deepening different construction methods of linear positive operators • Acquiring knowledge of Fourier analysis and wavelets analysis • Knowledge of the outstanding classes of approximation operators of discrete and continuous type

8. Content

8.1 Course	Teaching methods	Remarks
1. Positive linear operators: definitions, properties. Bohman-Korovkin theorems	Interactive exposure: explanation, conversation	
2. Moduli of smoothness. Properties	Interactive exposure: explanation, conversation	
3. Quantitative estimates. The error of approximation	Interactive exposure: explanation, conversation	
4. K – functionals. Properties	Interactive exposure: explanation, conversation	
5. Integral generalizations of discrete type approximation processes. Kantorovich and Durrmeyer operators	Interactive exposure: explanation, conversation	
6. Summation methods: Cesaro, Euler, Jakimovski	Interactive exposure: explanation, conversation	
7. Random approximation schemes. Feller type operators	Interactive exposure: explanation, conversation	
8. Approximation in periodical spaces	Interactive exposure: explanation, conversation	
9. Windowed Fourier transforms. Gabor formulas	Interactive exposure: explanation, conversation	
10. Wavelets. Franklin and Stromberg direction	Interactive exposure: explanation, conversation	
11. Multi resolution analysis	Interactive exposure: explanation, conversation	
12. On mother wavelet and father wavelet	Interactive exposure: explanation, conversation	
13. Wavelets decompositions and reconstructions	Interactive exposure: explanation, conversation	
14. Integral wavelets transform	Interactive exposure: Explanation, conversation	

Bibliography

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

[2] Francesco Altomare, Michele Campiti, *Korovkin – type Approximation Theory and its Applications*, de Gruyter Studies in Mathematics, Vol. 17, Walter de Gruyter, Berlin New York, 1994.

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

8.2 Seminar	Teaching methods	Remarks
1. Spaces of functions and their characteristic properties. Inequalities in normed spaces	Exercise, dialogue, individual study	
2. Best approximation to a given function	Exercise, dialogue, individual study	
3. Bernstein polynomials. Properties	Exercise, dialogue, individual study	
4. Discrete type linear positive operators: Szasz, Baskakov	Exercise, dialogue, individual study	
5. Convolution product. Properties	Exercise, dialogue, individual study	
6. Convolution operators. Approximation properties	Exercise, dialogue, individual study	
7. Reserved for a written paper (quiz)	Exercise, dialogue, individual study	
8. Stancu operators associated with the Markov-Polya urn scheme	Exercise, dialogue, individual study	
9. Fourier transforms. Problems on the theme of the same week lecture	Exercise, dialogue, individual study	
10. Window functions - calculating the center and radius	Exercise, dialogue, individual study	
11. Example of orthogonal wavelet – Haar function	Exercise, dialogue, individual study	
12. B – spline functions. Properties	Exercise, dialogue, individual study	
13. Examples of mother - wavelets	Exercise, dialogue, individual study	
14. Linear operators generated by a scaling function	Exercise, dialogue, individual study	

Bibliography

[4] Agratini, O., *Aproximare prin operatori liniari*, Presa Universitară Clujeană, Cluj-Napoca, 2000.

[5] Agratini, O., Chiorean, I., Coman, Gh., Trîmbițaş, R., *Analiză numerică și teoria aproximării*, Vol. III, Presa Universitară Clujeană, Cluj-Napoca, 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

This program covers the necessary basic knowledge in this area
Software companies consider important in that it provides a solid theoretical foundation in skills development programmer.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course		Written exam	65%
10.5 Seminar		Quiz Continous observations	25% 10%
10.6 Minimum performance standards			
➢ At least grade 5 (from a scale of 1 to 10) at written exam			

Date	Signature of course coordinator	Signature of seminar coordinator
March 10th, 2016	Octavian Agratini	Octavian Agratini

Date of approval	Signature of the head of department
March 15th, 2016	Octavian Agratini