

## SYLLABUS

### 1. Information regarding the programme

1.1 Higher education institution	<b>Babes-Bolyai University, Cluj-Napoca</b>
1.2 Faculty	<b>Mathematics and Informatics</b>
1.3 Department	<b>Mathematics</b>
1.4 Field of study	<b>Mathematics</b>
1.5 Study cycle	<b>Bachelor degree</b>
1.6 Study programme / Qualification	<b>Mathematics-Informatics</b>

### 2. Information regarding the discipline

2.1 Name of the discipline		<b>Numerical Analysis</b>					
2.2 Course coordinator		<b>Chiorean Ioana Rodica</b>					
2.3 Seminar coordinator							
2.4. Year of study	<b>2</b>	2.5 Semester	<b>4</b>	2.6. Type of evaluation	<b>exam</b>	2.7 Type of discipline	<b>compulsory</b>

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

3.1 Hours per week	5	Of which: 3.2 course	2	3.3 seminar/laboratory	1 sem+ 2 lab
3.4 Total hours in the curriculum	70	Of which: 3.5 course	28	3.6 seminar/laboratory	42
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					20
Additional documentation (in libraries, on electronic platforms, field documentation)					15
Preparation for seminars/labs, homework, papers, portfolios and essays					25
Tutorship					10
Evaluations					10
Other activities: .....					
3.7 Total individual study hours	80				
3.8 Total hours per semester	150				
3.9 Number of ECTS credits	<b>6</b>				

### 4. Prerequisites (if necessary)

4.1. curriculum	<ul style="list-style-type: none"> <li>• Analysis, Algebrae,</li> </ul>
4.2. competencies	<ul style="list-style-type: none"> <li>• Algorithmic skills</li> </ul>

### 5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> <li>•</li> </ul>
5.2. for the seminar /lab activities	<ul style="list-style-type: none"> <li>• MATLAB software</li> </ul>

## 6. Specific competencies acquired

<b>Professional competencies</b>	<ul style="list-style-type: none"> <li>• C1.1. Identify concepts, theories and use of specific language description</li> <li>• C3.2. Data interpretation and explanation of the steps involved in problem solving by algorithms</li> </ul>
<b>Transversal competencies</b>	CT3. Effective use of information sources and communication resources

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

7.1 General objective of the discipline	<ul style="list-style-type: none"> <li>• Introduction to the field of numerical analysis.</li> </ul>
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> <li>• The focus is on useful notions used by school teacher, and also for the future research in the domains as Applied Mathematics, Chemistry, Physics, Biology, etc. We also are interested to develop programming skills in MATLAB.</li> </ul>

## 8. Content

8.1 Course	Teaching methods	Remarks
1. Error theory	Lecture, examples	
2. Finite and divided differences	Lecture, examples	
3. Lagrange interpolation	Lecture, examples	
4. Hermite and Birkhoff interpolation	Lecture, examples	
5. Mean square approximation	Lecture, examples	
6. Bernstein polynomial and operator.	Lecture, examples	
7. Linear and positive operators	Lecture, examples	
8. Numerical integration. Newton-Cotes type formulas.	Lecture, examples	
9. Gauss and Cebasev numerical integration	Lecture, examples	
10. Direct methods for solving systems of linear equations	Lecture, examples	
11. Iterative methods for solving systems of linear equations	Lecture, examples	
12. Multigrid method	Lecture, examples	
13. Solving numerically equations on $\mathbb{R}$	Lecture, examples	
14. Numerical methods in parallel calculus	Lecture, examples	

### Bibliography

1. CHIOREAN,I., CATINAS,T., TRAMBITAS, R.T., Analiza Numerica, Presa Universitara Clujeana, Cluj-Napoca, 2010
2. CHIOREAN,I., Numerical Methods in Abstract Spaces, Presa Universitara Clujeana, Cluj-Napoca, 2008
2. COMAN,GH., CHIOREAN,I.,CATINAS,T., Advance Course on Numerical Analysis, Presa Universitara Clujeana, Cluj-Napoca, 2007

4. STANCU,D.D.: Analiza numerica, curs si culegere de probleme, Univ. Babes-Bolyai Cluj-Napoca, 1977 (lito).
5. AGRATINI,O.,BLAGA,P., CHIOREAN,I., COMAN,GH., STANCU,D.D., TRAMBITAS,R.T., Analiza numerica si teoria aproximarii(vol.I,II,III), Presa Univ.Clujeana, 2002
6. BLAGA,P.,COMAN,GH.,TRAMBITAS,R.T.,VASARU,D.,POP,S., Analiza numerica, lucrari de laborator, Univ. Babes-Bolyai Cluj-Napoca, 1995 (lito).
7. DEMIDOVICI,B.P.- MARON, A.: Elements de calcul numerique, Ed. Mir, Moscou, 1979.

8.2 Seminar / laboratory	Teaching methods	Remarks
1. Error theory, finite and divided differences	Dialog, explanations discussions	
2. Lagrange interpolation	Dialog, explanations discussions	
3. Hermite and Birkhoff interpolation	Dialog, explanations discussions	
4. Mean square approximation	Dialog, explanations discussions	
5. Bernstein polynomial,Fejer polynomial, linear and positive operators	Dialog, explanations discussions	
6. Numerical integration	Dialog, explanations discussions	
7. Solving systems of equations	Dialog, explanations discussions	

**Bibliography**

- 1.CHIOREAN,I., CATINAS,T., TRAMBITAS, R.T., Analiza Numerica, Presa Universitara Clujeana, Cluj-Napoca, 2010
2. STANCU,D.D.: Analiza numerica, curs si culegere de probleme, Univ. Babes-Bolyai Cluj-Napoca, 1977 (lito).

8.3 Laboratory	Teaching methods	Remarks
1. Introduction in MATLAB	Explanation, individual work	
2. Invers of a matrix, determinant computation	Explanation, individual work	
3. Difference and divided differences tables generation	Explanation, individual work	
4. Stirling numbers	Explanation, individual work	
5. Aitken method	Explanation, individual work	
6. Gauss method	Explanation, individual work	
7. Mean square approximation	Explanation, individual work	
8. Romberg algorithm	Explanation, individual work	
9. Jacobi method	Explanation, individual work	
10. Gauss-Seidel method	Explanation, individual work	
11. Chord method	Explanation,	

	individual work	
12. Tangent method	Explanation, individual work	
13. Combined methods	Explanation, individual work	
14. Close of activity	Discussions	
Bibliografie		
1. BLAGA,P.,COMAN,GH.,TRAMBITAS,R.T.,VASARU,D.,POP,S., Analiza numerica, lucrari de laborator, I Babes-Bolyai Cluj-Napoca, 1995 (lito).		
2. <a href="http://www.e-learn.ro/tutoriale/matlab/33.htm">http://www.e-learn.ro/tutoriale/matlab/33.htm</a>		

**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**

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|---|
| <ul style="list-style-type: none"> <li>• This Numerical Analysis curriculum covers the necessary basic knowledge in this area</li> <li>• Meets national and international requirements, in concordance with the programs of other universities</li> </ul> |
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**10. Evaluation**

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	1.Discretization of a given continuous problem	Written exam	70%
	2.Solving numerically the discret problem and the error study		
10.5 Seminar/lab activities	Using computer in solving numerical problems	Practical verification	30%
10.6 Minimum performance standards			
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Date

24-th of April 2020

Signature of course coordinator

conf.dr.Chiorean Ioana..

Signature of seminar coordinator

conf.dr..Chiorean Ioana

Signature of the head of department

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prof.dr. Agratini Octavian.....