

## SYLLABUS Numerical Calculus

### 1. Information on academic programme

1.1. University	„1 Decembrie 1918”
1.2. Faculty	Faculty of Sciences
1.3. Department	Science and Engineering Department
1.4. Field of Study	Computer Science
1.5. Cycle of Study	Undergraduate
1.6. Academic program / Qualification	Informatică/ Analist/251201, Programator de sistem informatic/251204, Inginer de sistem în informatică/251203 / 2512/ Software developers

### 2. Information of Course Matter

2.1. Course		Numerical calculus		2.2. Code		CSE 202	
2.3. Course Leader			Ovidiu Bagdasar				
2.4. Seminar Tutor			Ovidiu Bagdasar				
2.5. Academic Year	II	2.6. Semester	II	2.7. Type of Evaluation (E – final exam/ CE - colloquy examination / CA -continuous assessment)	E	2.8. Type of course (C– Compulsory, Op – optional, F - Facultative)	O

### 3. Course Structure (Weekly number of hours)

3.1. Weekly number of hours	4	3.2. course	2	3.3. seminar, laboratory	2
3.4. Total number of hours in the curriculum	56	3.5. course	28	3.6. seminar, laboratory	28
Allocation of time:					Hours
Individual study of readers					20
Documentation (library)					20
Home assignments, Essays, Portfolios					27
Tutorials					-
Assessment (examinations)					2
Other activities.....					-

3.7 Total number of hours for individual study	69
3.8 Total number of hours in the curriculum	56
3.9 Total number of hours per semester	125
3.10 Number of ECTS	5

### 4. Prerequisites (where applicable)

4.1. curriculum-based	-
4.2. competence-based	-

## 5. Requisites (where applicable)

5.1. course-related	Laboratory equipped with video projector / board
5.2. seminar/laboratory-based	Laboratory equipped with video projector / board

## 6. 6.1 Specific competences to be acquired (chosen by the course leader from the programme general competences grid)

Professional competences	-Analyze business processes -Translate requirements into a visual model - Manage engineering projects
Transversal competences	-

## 6.2 Learning outcomes according to degree field and/or branch of science

Knowledge	The student/graduate selects, explains, and specifies the mathematical foundations applied in computer science, including formal logic, algebra, probability and statistics.
Skills	The student/graduate applies, evaluates, proposes mathematical methods for modeling, simulating and solving computer science problems.
Responsibility and autonomy	The student/graduate develops interdisciplinary solutions by integrating mathematics with related fields and collaborating affectively with specialized teams.

## 7. Course objectives (as per the programme specific competences grid)

7.1 General objectives of the course	Introducing basic concepts and methods of numerical analysis. Initiating students in methods of numerical programming for solving mathematical problems and for start using numerical software. Students have to know the fundamental concepts of numerical analysis and various numerical algorithms. These specific objectives allow modeling and solving complex problems using knowledge of mathematics and informatics
7.2 Specific objectives of the course	Students must: -know the fundamental concepts of numerical analysis. -modeling and solving problems using knowledge of mathematics.  Achieving these specific objectives allows: C4.1 Define the concepts and principles of computer science and mathematical theories and models; C4.2 Interpretation of mathematics and computer science models(formal). C4.3 Identifying appropriate models and methods to solve real problems. C4.4 Using simulation for studying the behaviour of the realized models and performance evaluation. C4.5 Incorporation of formal models in specific applications in various fields.

## 8. Course contents

8.1 Course (learning units)	Teaching methods	Remarks
(1) 1. Elements of approximation theory and matrix analysis	<i>Lecture, conversation, exemplification</i>	<b>2 hours – Face to face</b>

1.1 Analysis and evaluation of arithmetic expressions		
(2) 1.2 Items of errors theory and floating point arithmetic 1.3 Calculating the determinant and inverse of a matrix	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(3) 2. Methods and numerical algorithms. Differences calculus 2.1 Gauss elimination method	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(4) 2.2 Total elimination method	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(5) 3. Functions approximations 3.1 Cholesky method 3.2 Onicescu method	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(6) 3.3 Iterative methods 3.4 Successive approximations method	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(7) 3.5 Tangent method 3.6 Secant method	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(8) 4. Numerical differentiation and integration algorithms 4.1 Bairstrov method	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(9) 4.2 Finite differences methods	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(10) 4.3 Divided differences methods	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(11) 5. Numerical algorithms for solving algebraic equations 5.1 Approximation in mean square	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(12) 5.2 Numerical differentiation	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(13) 6. Items of Symbolic Calculus 6.1 Quadrature formulas of Gauss and Newton Cotes type 6.2 Numerical integration using Taylor series	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
(14) 6.3 Multipas methods	<i>Lecture, conversation, exemplification</i>	2 hours – Face to face
<b>8.2 Bibliography</b>		
1.Eugen K. Blum – Numerical Analysis and Computation: Theory and Practice, Addison-Wesley, 1972. 2.R.L. Burden, L.J. Faires – Numerical Analysis, PWS Kent, 1986 3.S. Nakamura – Numerical Analysis and Graphic Visualization in MATLAB, Pretice-Hall, 1996 4. Cesar Perez Lopez, MATLAB Programming for Numerical Analysis, Apress, 2014 5. William Bober, Chi-Tay Tsai, Oren Masory, Numerical and Analytical Methods with MATLAB, CRC Press, 2009		
<b>Seminars-laboratories</b>	<b>Teaching methods</b>	

(1) 1. Elements of approximation theory and matrix analysis 1.1 Analysis and evaluation of arithmetic expressions	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
(2) 1.2 Items of errors theory and floating point arithmetic 1.3 Calculating the determinant and inverse of a matrix	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
(3) 2. Methods and numerical algorithms. Differences calculus 2.1 Gauss elimination method	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
(4) 2.2 Total elimination method	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
(5) 3. Functions approximations 3.1 Cholesky method 3.2 Onicescu method	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
(6) 3.3 Iterative methods 3.4 Successive approximations method	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
(7) 3.5 Tangent method 3.6 Secant method	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
(8) 4. Numerical differentiation and integration algorithms 4.1 Bairstrov method	<i>Questioning, samples, demonstration</i>	2 hours – Face to face
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### **Bibliography**

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2. R.L. Burden, L.J. Faires – Numerical Analysis, PWS Kent, 1986
3. S. Nakamura – Numerical Analysis and Graphic Visualization in MATLAB, Prentice-Hall, 1996
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5. William Bober, Chi-Tay Tsai, Oren Masory, Numerical and Analytical Methods with MATLAB, CRC Press, 2009

**9. Corroboration of course contents with the expectations of the epistemic community’s significant representatives, professional associations and employers in the field of the academic programme**

*Gaining knowledge by the students regarding this discipline assumes a training on the labour market in such way that they can solve any problems that appear by creating proper mathematics models.*

**10. Assessment**

Activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Percentage of final grade
10.4 Course	<i>Final evaluation</i>	Practical exam	60%
	-	-	-
10.5 Seminar/laboratory	<i>Continuous assessment</i>	<i>Laboratory activities portfolio</i>	40%
	-		-

**10.6 Minimum performance standard:**

In order to obtain credits for this discipline, the students have to operate with elementary items of numerical analysis and use soft for solving different mathematical problems.

Attendance at courses and seminars according to the general requirements of the faculty.

- knowledge of the basics (minimum grade 5 at the final evaluation)
- the ability to apply theoretical notions in practice (minimum 5 seminar average)

The final grade is calculated as the arithmetic mean of the grades awarded for the components specified in 10.4 and 10.5. The exam is considered to be passed if the average is at least 5 (the marks from 10.4 and 10.5 must be higher than 5 each). At each of the exam sessions (including the ones of rest and enlargement) the mark is calculated according to the same rule. In the overdue / enlargement session, only the evidence for which no promotion note has been obtained (minimum 5) can be claimed, unless the student wishes to support the evidence already promoted.

Note: Students can participate in the consultation hours (2 modules / week according to the schedule established at the beginning of the semester) in which the course holder and / or seminar / laboratory answers the students' questions and offers additional explanations related to the content of the course, the laboratory applications and themes.

Submission date

Course leader signature

Seminar tutor signature

27.09.2025

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Date of approval by Department members

Department director signature

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Date of approval by Faculty council

Dean of faculty

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