SYLLABUS

Numerical Calculus

1. Information on academic programme

1.1. University	**„1 Decembrie 1918" of Alba Iulia**
1.2. Faculty	**Faculty of Informatics and Engineering**
1.3. Department	**Informatics, Mathematics and Electronics**
1.4. Field of Study	**Computer Science**
1.5. Cycle of Study	**Undergraduate**
1.6. Academic program / Qualification	**ESCO-08: 2511/ Systems Analyst, 2512/ Software developers Analyst 251201** **Computer System Programmer 251204** **Computer System Engineer 251203**

2. Information of Course Matter

2.1. **Course**		**Numerical calculus**		2.2. **Code**		**CSE 210**	
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)	**C**

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	***15***
Documentation (library)	***15***
Home assignments, Essays, Portfolios	***12***
Tutorials	**-**
Assessment (examinations)	***2***
Other activities…….	**-**

3.7 Total number of hours for individual study	44
3.8 Total number of hours in the curriculum	56
3.9 Total number of hours per semester	100
3.10 Number of ECTS	4

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 / boar
5.2. seminar/laboratory-based	Laboratory equipped with video projector / boar

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

Professional competences	**C4.5 The embedding of formal models in specific applications in various domains.** After browsing the course, the students will gain skills in the use of numerical calculus for transposition of problems in various programming languages. So the discipline contributes to the formation of some general skills specific for the study domain.
Transversal competences	-

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 analysisand 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 1.1 Analysis and evaluation of arithmetic expressions	***Lecture, conversation, exemplification***	**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	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(3) 2. Methods and numerical algorithms. Differences calculus 2.1 Gauss elimination method	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(4) 2.2 Total elimination method	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(5) 3. Functions approximations 3.1 Cholesky method 3.2 Onicescu method	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(6) 3.3 Iterative methods 3.4 Successive approximations method	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(7) 3.5 Tangent method 3.6 Secant method	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(8) 4. Numerical differention and integration algorithms 4.1 Bairstrov method	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(9) 4.2 Finite differences methods	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(10) 4.3 Divided differences methods	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(11) 5. Numerical algorithms for solving algebraic equations 5.1 Approximation in mean square	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(12) 5.2 Numerical differentiation	***Lecture, conversation, exemplification***	**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	***Lecture, conversation, exemplification***	**2 hours – Face to face**
(14) 6.3 Multipas methods	***Lecture, conversation, exemplification***	**2 hours – Face to face**

8.2 Bibliography

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

Seminars-laboratories	**Teaching methods**	
(1) 1. Elements of approximation theory and matrix analysis 1.1 Analysis and evaluation of arithmetic expressions	***Questioning, samples, demonstration***	**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	***Questioning, samples, demonstration***	**2 hours – Face to face**
(3) 2. Methods and numerical algorithms. Differences calculus 2.1 Gauss elimination method	***Questioning, samples, demonstration***	**2 hours – Face to face**
(4) 2.2 Total elimination method	***Questioning, samples, demonstration***	**2 hours – Face to face**
(5) 3. Functions approximations 3.1 Cholesky method 3.2 Onicescu method	***Questioning, samples, demonstration***	**2 hours – Face to face**
(6) 3.3 Iterative methods 3.4 Successive approximations method	***Questioning, samples, demonstration***	**2 hours – Face to face**
(7) 3.5 Tangent method 3.6 Secant method	***Questioning, samples, demonstration***	**2 hours – Face to face**
(8) 4. Numerical differention and integration algorithms 4.1 Bairstrov method	***Questioning, samples, demonstration***	**2 hours – Face to face**
(9) 4.2 Finite differences methods	***Questioning, samples, demonstration***	**2 hours – Face to face**
(10) 4.3 Divided differences methods	***Questioning, samples, demonstration***	**2 hours – Face to face**
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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	*Final evaluation*	Practical exam	60%
	-	-	-
10.5 Seminar/laboratory	*Continuous assessment*	*Laboratory activities portfolio*	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

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Date of approval by Department members | Department director signature

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