SYLLABUS

Approved,
DEAN

1. Program Data

1.1. Institution of Higher Education	**Babeș-Bolyai University**
1.2. Faculty	**Faculty of Engineering**
1.3.Department	**Department of Engineering Science**
1.4. Field of Study	**Electrical Engineering**
1.5. Course of Study	**Bachelor**
1.6. Study Programme	**Electromechanics**

2. Discipline Data

2.1. Discipline Name	Numerical Methods						
2.2. Course Coordinator		**Ioan-Florin Bugariu, PhD**					
2.3.1. Seminary Coordinator							
2.3.2. Laboratory Coordinator		**Ioan-Florin Bugariu, PhD**					
2.3.3. Project Coordinator							
2.4. Year of Study	II	2.5. Semester	3	2.6. Evaluation Time	E	2.7. Discipline Regime	Man.

3. Estimated Total Time (hours per semester of teaching activities)

3.1. Number of Hours per Week	**4**	from which: 3.2. Course	**2**	3.3. laboratory & project	**2**
3.4. Total Hours from the Curriculum Plan	**56**	from which: 3.5. Course	**28**	3.6. laboratory & project	**28**
Time Fund Distribution - hours					**44**
Study of Handbook, Course Materials, Bibliography & Notes					**10**
Additional Documentation in Library, on Special E-learning Platforms & in the Field					**15**
Preparation of seminaries/laboratories/ projects, topics, reports, portfolios & essays					**17**
Mentoring					**-**
Examination					**2**
Other Activities					**-**

3.7. Total Time of Individual Study	**44**
3.8. Total Hours per Semester	**100**
3.9. Number of Credits	**4**

4. Pre-condition (where is the case)

4.1. of Curriculum	• Computer programming and operation systems • Applied informatics and algorithms
4.2. of Competences	• Solving engineering problems and applying general methods • Scilab software know-how

5. Condition (where is the case)

5.1. of Course Progress	• PC/laptop, Internet access, Microsoft Teams account
5.2.1. of Seminary Progress	•
5.2.2. of Laboratory Progress	• PC/laptop, Internet access, Microsoft Teams account
5.2.3. of Project Progress	•

6. Acquired Specific Competences

Professional Competences	• Using specialized knowledge of mathematics, physics, computer science, specific for the field of applied engineering sciences. (CP 1). • Working with specialized concepts from the field of computer technology and information technology. (CP 2)
Transversal Competences	• Identifying main objectives, available resources, necessary conditions, the work phases, deadlines and related risks to achieve them (CT 1). • Efficient use of information resources, of communication skills and training resources (internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in a language of international circulation. (CT 3).

7. Discipline Objectives (coming out from the Checklist of Acquired Specific Competences)

7.1. General Objective of Discipline	• Developing student's ability to understand the methodology of using mathematical model algorithms to solve engineering problems in the field of industrial informatics, automotive and industrial automation. Transposing numerical model algorithms into program source codes and implementing them on a computer.
7.2. Specific Objectives	• Theoretical study and practical applications of mathematical models.

8. Content

8.1. Course	Teaching methods	Observation
1. Introduction in Numerical Analysis Algorithms, pseudocode **Errors**. Errors type. Cause and effect.	Presentation; Discussion.	2 hours
2. Solving linear systems of equations Direct methods: Gauss elimination process	- // -	2 hours
3. Solving linear systems of equations Direct methods: LR factorization (Doolittle and Croût) method	- // -	2 hours
4. Solving linear systems of equations Iterative methods: Siedel-Gauss, Jacobi method	- // -	2 hours
5. Determinants Chio and Gauss method	- // -	2 hours
6. Inverse matrix Direct method: Gauss; Iterative methods	- // -	2 hours
7. Solving nonlinear equations and systems of equations Newton's method. Bisection method. Iterative methods	- // -	2 hours
8. Polynomials roots. Bairstow method	- // -	2 hours
9. Eigenvalues and eigenvectors Krylov's method.	- // -	6 hours
10. Polynomial interpolation	- // -	2 hours
11. Integrals numerical approximation Simpson's method	- // -	2 hours
12. Numerical approximations of differential equations Euler's method, Runge-Kutta method.	- // -	2 hours
Bibliography 1. A. Hadar, C. Marin, C. Petre și A. Voicu, "*Metode Numerice în Inginerie",* Politehnica Press, București, 2004. 2. M. Racilă, *Metode numerice - Manual de curs, versiune electronică*, 2019-2020. 3. A. Ralston și P. Rabinowitz, *A first course in numerical analysis,* McGraw-Hill, New York, 1978. 4. 4. J. Stoer și R. Bulirsch, *Introduction to numerical analysis,* Springer-Verlag, Berlin, 1980.		
8.2.2. Laboratory	Teaching methods	Observation
1. Pseudocode and Scilab introduction	Brainstorming Solving specific numerical problems, by applying the presented methods	2 hours
2. Solving linear systems		6 hours
3. Determinants		2 hours
4. Solving nonlinear equations and systems of equations		4 hours
5. Eigenvectors and eigenvalues		2 hours
6. Polynomial interpolation		4 hours
7. Integrals numerical approximation		2 hours
8. Numerical approximations of differential equations		2 hours
9. Project presentation		4 hours
Bibliography 1. A. Hadar, C. Marin, C. Petre și A. Voicu, "*Metode Numerice în Inginerie",* Politehnica Press, București, 2004. *2.* M. Racilă, *Metode numerice - Manual de curs, versiune electronică,* 2019-2020. *3.* A. Ralston și P. Rabinowitz, *A first course in numerical analysis,* McGraw-Hill, New York, 1978. *4.* J. Stoer și R. Bulirsch, *Introduction to numerical analysis,* Springer-Verlag, Berlin, 1980.		

9. Corroborating Discipline's Contents with the Expectation of the Epistemic Community Representatives, the Professional Associations and the Employers' Representatives from the Programme Corresponding Field

- They have been established with the main employers by previous discussions at the study programme substantiation.

10. Evaluation

Type of activity	10.1. Evaluation criteria	10.2. Evaluation methods	10.3. Weight from the final grade
10.4. Course	Debates participation	Number of interventions	10%
	Acquired knowledge level	Exam (on paper)	60 %
10.5.1. Seminary	Activity / implication		
	Gained competence level		
10.5.2. Laboratory	Activity / implication	Number of interventions	10 %
	Gained competence level in practice	Exam (using Scilab)	20 %
10.5.3. Project	Readiness in phrasing the project stages		
	Project quality		
10.6. Performance Minimum Standard			
• Completion of Applicative Activities (laboratory work accomplishment and project approval by the minimum grade of 5). • Completion of each exams subject by the minimum grade of 5.			

Completion Date	Course Coordinator's Signature	Laboratory / Project Coordinator's Signature
May 2022	**Ioan-Florin Bugariu, PhD**	**Ioan-Florin Bugariu, PhD**
Department Endorsement Date		Chief of Department Signature
.....		**Ș.l. dr. fiz. Hațiegan Cornel**