ROMANIAN ACADEMY
School of Advanced Studies of the Romanian Academy (SCOSAAR)
COURSE SHEET: ‚Methods of solving ordinary differential equations'

1. Program Information

1.1 Department	Department of engineering, mechanical, computer sciences
1.2 Institution	Romanian Academy
1.3 Field of studies	Engineering sciences
1.4 Cycle of studies	PHD

2. Course information

2.1 Name of the course			**Methods of solving ordinary differential equations**				
2.2 Holder of course activities			Nicolae POP, CSI dr. habil.				
2.3 Holder of seminar activities			Nicolae POP, CSI dr. habil.				
2.4 Holder of laboratory activities							
2.5 Year of study	**I**	**2.6 Semester**	I	**2.7 Type of ssessment**	E*	**2.8 Course regime**	DS**

3. Estimated total time (hours per semester of teaching activities)

3.1 Number of hours per week	15	**From which:**			
3.2 course	9	**3.3 seminar**	6	**3.4 laboratory**	0
3.5 Total hours from the curriculum	210	**From which:**			
3.6 course	126	**3.7 seminar**	84	**3.8 laboratory**	0
3.9 Total hours per semester	210				
3.10 Number of credits	15				

4. Course content

1. One-step approximation methods
2. Euler's method. Modified Euler method and Heun method
3. Multi-stage approximation methods, order of convergence, order of consistency and stability
4. Specific multi-stage methods: Adams method, Adams-Bashfort method, Adams-Multon method, Nyström method and Milne-Simpson method
5. Picard's method of successive approximations
6. The Runge-Kutta method
7. Disturbance method
8. Mediation method
9. The method of non-autonomous dynamic systems. The Van der Pol plan
10. Stability of periodic solutions of nonlinear dynamic systems

5. The objectives of the course and the specific skills acquired

1. The general objective of the discipline: Knowledge and understanding of numerical algorithms for solving ordinary differential equations.
2.- Specific objectives:
Acquiring knowledge in the application of algorithms and the use of software containing the analyzed methods.
- The study of some dynamic systems modeled with differential equations and examples of application of the studied methods.
- Classical examples of numerical solutions. Runge-Kutta method of order IV.

6. Bibliography

1. Verhulst, F., *Nonlinear Differential Equations and Dynamical Systems*, 1990, Springer-Verlag, Berlin, Heidelberg, New York, London, Paris, Tokyo, Hong Kong.
2. Pavaloiu, I., Pop, N., *Interpolare si aplicatii*, Editura Risiprint, Cluj-Napoca, 2005
3. Pavaloiu, I., Pop, N., *Interpolation and Applications*, Lambert Academic Publishing, Printed by Schaltungsdienst Lange o.H.G., Berlin, 2017
4. Voinea, R.,Stroe, I., *Introducere in teoria sistemelor dinamice*, Editura Academiei Romane, Bucuresti, 2000
5. Stanescu, D, Muneteanu, L, Chiroiu, V, Pandrea, N, N. *Sisteme dinamice*, Vol.1,2, Ed.Academiei 2007, 2011
6. Lefter, C-G., *Ecuatii diferentiale si sisteme dinamice*, Editura Alexandru Myller, Iasi, 2006

7. Assement

Type of activity	**7.1 Evaluation criterias**	**7.2 Evaluation methods**	**7.3 Weight of the final grade**
7.4 Course	Knowledge acquired	Written exam	55%
7.5 Seminar	Activity	Case studies presented	45%
7.6 Laboratory			
7.7 Standard minim de performanţă: Cunoașterea a 70% din informația conținută în curs			

*E = Exam. C = Colloquium.

**DF = Fundamental Discipline. DS = Specialty Discipline.

Course structure
November 2023 – May 2024 – Teaching activity - Methods of solving ordinary differential equations, IMSAR
Exam May 2024
Holder of the course: Dr. Nicolae Pop