COURSE PROGRAMME

1. Information about the programme

1.1 University	**University "Alexandru Ioan Cuza" of Iasi**
1.2 Faculty	**Faculty of Mathematics**
1.3 Department	**Department of Mathematics**
1.4 Domain	**Mathematics**
1.5 Cycle	**Masters**
1.6 Programme / Qualification	**Applied Mathematics**

2. Information about the course

2.1 Course Name	Differential systems and applications						
2.2 Course taught by	Prof. PhD. SEBASTIAN ANITA						
2.3 Seminary / laboratory taught by	Prof. PhD. SEBASTIAN ANITA						
2.4 Year	I	**2.5** Semester	II	**2.6** Type of evaluation*	E	**2.7** Course type**	Ob

**E – Exam / C – Colloquium / V – Verification*

***OB – Obligatory / OP – Optionally / F – Facultative*

3. Total hours (estimated per semester and activities)

3.1 Number of hours per week	4	**3.2** course	2	**3.3** seminary/laboratory	2
3.4 Total number of hours	56	**3.5** course	28	**3.6** seminary/laboratory	28

Distribution	hours
Individual study using textbooks, course notes, bibliography items, etc.	56
Supplimentary study (library, on-line platforms, etc.)	0
Individual study for seminary/laboratory, homeworks, projects, etc.	59
Tutoring	0
Examination	4
Other activities	0

3.7 Total hours of individual activity*	119
3.8 Total hours per semester	175
3.9 Credit points	7

4. Pre-requisites - Curriculum (if necessary)

Differential Equations

5. Conditions (if necessary)

5.1 Course	Classes will be held in the amphitheater
5.2 Seminary / Laboratory	Classes will be held in the seminary/laboratory rooms

6. Objectives

Upon successful completion of this discipline, students will be able to:
• Describe different phenomena in science and economics using differential equation systems
• Use theoretical results to establish new qualitative results for solutions to differential systems
• Use theoretical results to study optimal control issues associated with economic models
• Use Matlab to highlight the properties of solutions of differential systems and to approximate the optimal control in case of optimal control problems

7. Specific competencies/Learning outcomes

- conducts quantitative research
- applies scientific methods
- performs analytical mathematical calculations

8. Contents

8.1 Course	**Teaching methods**	**Remarks** (number oh hours, references)
Classical mathematical models of the dynamics of single population species described by differential and integro-differential equations. Stability of steady states	Exposition, conversation, proof and problematization	4 hours, [2]
Classical mathematical models of interacting populations. Stability of steady states	Exposition, conversation, proof and problematization	4 hours, [1], [2]
Mathematical models in epidemics. SI and SIS models	Exposition, conversation, proof and problematization	2 hours, [1]
Mathematical models in epidemics. SIR and SIRS models	Exposition, conversation, proof and problematization	4 hours, [1]
Age-structured population dynamics with logistic term and migration	Exposition, conversation, proof and problematization	4 hours, [1]
Asymptotic behavior of the solution to the linear age-structured population dynamics	Exposition, conversation, proof and problematization	2 hours, [1]
Optimal harvesting problem and the profit maximization problem	Exposition, conversation, proof and problematization	4 hours, [1], [3]
Mathematical models in economics	Exposition, conversation, proof and problematization	4 hours, [1]

Bibliography

1. S. Anița,V. Arnăutu, V. Capasso, An Introduction to Optimal Control Problems in Life Sciences and Economics, Birkhauser, 2011
2. V. Barbu, Ecuaţii diferenţiale, Editura Junimea, Iaşi, 1985
3. H. Brezis, Analyse Fonctionnelle, Dunod, 2005

8.2 Seminary / Laboratory	**Teaching methods**	**Remarks** (number oh hours, references)

8.2 Seminary / Laboratory	Teaching methods	Remarks (number oh hours, references)
Classical models of population dynamics. Stability of steady states	Exercise and conversation, modelling	2 hours (sem)
Classical models of population dynamics. Stability of steady states. Matlab simulation	Exercise and conversation, modelling	2 hours (lab)
Classical mathematical models of interacting populations. Stability of steady states	Exercise and conversation, modelling	4 hours (sem)
Classical mathematical models of interacting populations. Stability of steady states. Matlab simulation	Exercise and conversation, modelling	4 hours (lab)
Lotka-Volterra's model. Qualitative analysis	Exercise and conversation, modelling	2 hours (sem)
Mathematical models in epidemics	Exercise and conversation, modelling	4 hours (sem)
Mathematical models in epidemics. Matlab simulation	Exercise and conversation, modelling	4 hours (lab)
Age-structured population dynamics with logistic term and migration. Matlab simulation	Exercise and conversation, modelling	2 hours (lab)
Mathematical models and optimal control problems in economics. Matlab simulation	Exercise and conversation, modelling	4 hours (lab)

Bibliography

1. S. Anița,V. Arnăutu, V. Capasso, An Introduction to Optimal Control Problems in Life Sciences and Economics, Birkhauser, 2011

9. Coordination of the contents with the expectations of the community representatives, professional associations and relevant employers in the corresponding domain

The course aims to provide new mathematical knowledge useful in mathematical modelling of phenomena in Biology, Life Sciences and Economics.
The seminar and lab aim at acquiring algorithms and applying them in specific situations, developing mathematical reasoning, using learning resources for personal and professional development. The Matlab simulations confirm the validity of the theoretical results and provide valuable information in situations not covered by theoretical results

10. Assessment and examination

10.1 Continuous assessment		Percentage (min. 30%)	50	
Course	Assessment type			
	Percentage		0	
	Failure to pass the continuous assessment results in failure to pass the final assessment			
	Assessment methods	Details	Percentage	with reexamination
Seminary / Laboratory	Assessment type		Mixed assessment	
	Percentage		100	
	Failure to pass the continuous assessment results in failure to pass the final assessment		No	
	Assessment methods	Details	Percentage	with reexamination
		Test	50	No
		Current assessment	50	No

10.2 Final assessment	Percentage (max. 70%)	50
	Assessment type	Final mixed assessment

10.3 Special notes (special situations is assessment)
LA EVALUAREA FINALA: Din ponderea de 50%: 40% - examenul scris si 10% - examinarea orala

10.4 Minimum performance standard
Defining notions, stating and applying fundamental theoretical results to solving simple problems. Identifying and using the appropriate methods to investigate some real-world problems (derive mathematical models to describe the phenomena, obtain the basic properties of the solutions to the mathematical models). Proving studied mathematical results with medium difficulty and getting Matlab simulations to confirm the validity of the theoretical results or to provide information in situations not covered by theoretical results.

Date,

Course coordinator,
Prof. PhD. SEBASTIAN ANITA

Seminary coordinator,
Prof. PhD. SEBASTIAN ANITA

Aproval date in the department,

Head of the departament,
Prof. PhD. IONEL DUMITREL GHIBA