COURSE SYLLABUS

University	**Alexandru Ioan Cuza University of Iaşi**	**Course title**	
Faculty	**Physics**	**Introduction to the Simulation of Discrete Events. Ising and Monte Carlo Models.**	
Department	**Physics**		
Domain	**Physics**	**Course category** (FC/SC/CC[1]):FC	**Term** (1-4):2
Level	**Postgraduate (MA)**	**Course type** (Co/El/F[2]):Co	

I. Course structure

Number of hours/week				Credits	Total class hours/ semester	Total hours of individual activity	Examination type (C/Ex/CE[3])	Teaching language
Course	Seminar	Lab.	Project	**6**	**56**	**124**	**Ex**	**English**
2	**-**	**2**	**-**					

II. Instructors

	Academic degree[4]	Scientific degree	Name and surname	Faculty position (tenure/ associate - organization)
Course	Lecturer	Dr.	ENACHESCU Cristian	tenure
Seminar				
Laboratory	Lecturer	Dr.	ENACHESCU Cristian	tenure

III. Prerequisites

Programming languages (B. Sc. Level course)

IV. Course objectives

- Making students familiar with the most important elements of the Monte Carlo method and of the Ising models
- The students should be able to apply the method to solve problems in physics and other sciences such as economics and social sciences.
- The course puts the theoretical basis of the random numbers generators. The specific methods of optimization of Monte Carlo results will be discussed.

V. Course content

Course	Ising models general presentation. 1D, 2D and 3D cases: Theoretical treatment and phase transition study in Ising models. Special types of Ising models: Random Anizotropy Ising, Random Field Ising. Spin glasses. Edward Anderson Spin Glass model. Elements of probability theory and statistics. Random numbers generation. Sampling in Monte Carlo method. Random uniform variables. Monte Carlo metropolis. Random Walks. Glauber dynamics. Markov chains. Dynamic Monte Carlo methods. Monte Carlo Entropic Sampling. Finite systems studies. Statistical analysis of data. Optimization and variance reduction methods. Monte Carlo in economics and social sciences. Risk analysis. Cellular automata.
Seminar	
Laboratory	During the laboratories, students work practically on topics presented during courses.

VI. Minimal required references

[1] G.S.Fishman, Monte Carlo: Concepts, Algorithms, and Applicatioins, Springer Verlag, New York. (1995)
[2] *Monte Carlo Methods in Statistical Physics*, ed. K. Binder, Springer- Verlag 1979
[3] K. Binder and D.W. Heermann,. *Monte Carlo Simulation in Statistical Physics. An Introduction* (4th edition). Springer. (2002)

VII. Didactic methods

[1] FC – fundamental course, SC – specialty course, CC – complementary course
[2] Co – compulsory, El – elective, F – facultative
[3] C – colloquium, Ex – exam, CE – colloquium AND exam
[4] Professor / Associate professor / Lecturer / Assistant professor / Teaching assistant

Course: Exposition, exemplification, algorithm discussions applied to the presented themes **Laboratory:** Learning through applications, homework, projects

VIII. Assessment

Pre-conditions	Attendance to all laboratories, obtaining the minimal grade 5 for each ongoing assessment	
Exam dates	**1st Assessment**	**April**
	2nd Assessment	**June**

	Assessment means and methods	**Percentage of the final grade**
Exam/Colloquium	Partial evaluation at mid semester Final evaluation	40% 40%
Seminar		
Laboratory	Formative evaluation during laboratory	20%