COURSE SYLLABUS

University	**Alexandru Ioan Cuza University of Iaşi**	**Course title**	
Faculty	**Physics**	**Theoretical and numerical micromagnetics**	
Department	**Physics**		
Domain	**Physics**	**Course category** (FC/SC/CC[1]): FC	**Term** (1-4): 4
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	**0**	**2**	**0**					

II. Instructors

	Academic degree[4]	Scientific degree	Name and surname	Faculty position (tenure/ associate - organization)
Course	Professor	Ph.D.	Alexandru Stancu	Tenure
Seminar				
Laboratory	Assistant prof.	Ph.D.	Radu Tanasa	Tenure

III. Prerequisites

Mathematics. General physics. Modeling and simulation. Solid state physics.

IV. Course objectives

The students will acquire knowledge in the theoretical micromagnetics (Brown's theory) and in numerical methods used in micromagnetism. The aim of the course is to present the fundamental elements in this field and to show the main elements in the implementation of a micromagnetic model. The laboratory works are dedicated to the practical numerical implementation of the models discussed at the lectures.

V. Course content

Course	Theoretical micromagnetics. The nucleation field in the coherent rotation model for the fine ferromagnetic particles. Critical volume. Other magnetization modes (curling). Coherent rotation model. Reversible susceptibility in the Stoner-Wohlfarth model. The role of higher-order terms in the anisotropy series expansion. Ferromagnetic resonance of the Stoner-Wohlfarth ferromagnetic particle. Magnetic moment dynamic. Landau-Lifshitz-Gilbert (LLG) model. Numerical implementation. Numeric micromagnetism. Calculus of magnetostatic field. Test problems in micromagnetics. Switching. Precessional switching of the magnetic moment in thin films. Systems of interacting ferromagnetic particles.
Seminar	
Laboratory	Implementation of numerical algorithms: Stoner-Wohlfarth (SW) model, Brown's model for the critical volume, Transverse susceptibility of the SW particle, LLG model for one particle, magnetostatic interaction field calculation, magnetic moment dynamic for systems of two single-domain particles.

VI. Minimal required references

1. Hillebrands, B., Ounadjela, K., (Eds.), "Spin dynamics in confined magnetic structures", vol. I-III, Springer Verlag 2003
2. Aharoni, A., "Introduction to the theory of ferromagnetism", Oxford Science Publications, 1998.
3. A. Stancu, "Magnetization processes in particulate ferromagnetic media", Cartea Universitară, 2006.

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

Lectures, discussions, experiments, laboratory works, computer simulations, didactic films.

VIII. Assessment

Pre-conditions	At least 50% presence at the courses and laboratories	
Exam dates	**1st Assessment**	**April**
	2nd Assessment	**June**

	Assessment means and methods	**Percentage of the final grade**
Exam/Colloquium	Scientific project (oral)	40 %
Seminar		
Laboratory	Numerical implementation of models	60%