COURSE SYLLABUS

University	**Alexandru Ioan Cuza University of Iaşi**	**Course title**	
Faculty	**Physics**	**Nanotechnologies applied to integrated circuits fabrication**	
Department	**Physics**		
Domain	**Physics**	**Course category** (FC/SC/CC[1]): SC	**Term** (1-4): 3
Level	**Postgraduate (MA)**	**Course type** (Co/El/F[2]): El	

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	**5**	**56**	**94**	**C**	**English**
2		**2**						

II. Instructors

	Academic degree[4]	Scientific degree	Name and surname	Faculty position (tenure/ associate - organization)
Course	Associate prof.	Ph.D.	Brinza Florin	tenure
Seminar				
Laboratory	Associate prof.	Ph.D.	Brinza Florin	tenure

III. Prerequisites

Nanotechnologies, Solid State Physics, Solid State Devices and Circuits

IV. Course objectives

The main objective is to create a base of knowledge in the field of IC manufacturing at down scales. This base include suitable physical properties of materials used in IC manufacturing, basic technologies of materials engineering, specific technologies for integrated circuit manufacturing. After course, students are able to describe technologies, special processes and problems in ultra high density and down-scale IC manufacturing.

V. Course content

Course	**A review of mains materials and technologies in solid state devices.** Techniques for crystals growth, thin films deposition, epitaxial growth. **Electrodepositing.** Elementary processes, terminology, physical phenomena at electrode-electrolyte interface. Formation of solid phases; phenomena, theories, models. Industrial plants for electrodeposition. **Thermal evaporation.** Basics of method. Equipments. Applications. **Cathode sputtering.** Basics. Equipments for industrial production. Cathode sputtering types. **Modern methods in thermal evaporation.** Evaporation using particles beam. Pulsed laser deposition. **Epitaxial growth.** Basics of method. Experimental arrangement. Crystallographic requirements. **Lithographic techniques.** Basics of lithographic method. Materials and equipments. Micro- and nano-lithography. **Selective chemical etching. Package of integrated circuits.** Chip-edge bonding. Cases classification. Packaging technologies.
Seminar	
Laboratory	1. Obtaining thin films using thermal evaporation. 2. Nanostructured thin films obtained by electrodeposition. 3. Obtaining thin films by self-assembly technology. 4. Anodization of aluminium. Functionalization. 5. Obtaining lithographyc masks. 6. Microstructures by lithography. 7. Characterization of nanostructures.

VI. Minimal required references

1. Charles Kittel, Introduction to solid state physics, 8-th edition, John Wiley and Sons, 2004.
2. Kenneth J. Klabunde (Editor), Nanoscale Materials in Chemistry, John Wiley & Sons, Inc., 2001.

[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

3. Stephen Beeby, Graham Ensell, Michael Kraft, Neil White, MEMS Mechanical Sensors, 2004, ARTECH HOUSE, INC., Norwood.
4. Ampere A. Tseng (editor), Nanofabrication. Fundamentals and Applications, World Scientific Publishing, Singapore, 2008.

VII. Didactic methods

Course: multimedia assisted exposition and conversation.
Laboratory: lecture and active methods (research and exploitation activity)

VIII. Assessment

Pre-conditions	Attendance (all activities), active participation to laboratory activities.	
Exam dates	**1st Assessment**	**week 8**
	2nd Assessment	**week 16**

	Assessment means and methods	**Percentage of the final grade**
Exam/Colloquium	Collloquium – 1st Assessment Reporting individual study results-2 st Assessment.	30 % 30 %
Seminar		
Laboratory	Collloquium	40 %