

COURSE SYLLABUS

University	Alexandru Ioan Cuza University of Iași	Course title	
Faculty	Physics	BIOMATERIALS and BIOCOMPATIBILITY	
Department	Physics		
Domain	- Plasma Physics, Spectroscopy and Self-Organization - Biophysics and Medical Physics	Course category (FC/SC/CC¹): SC	Term (1-4): 3
Level	Postgraduate (MA)	Course type (Co/EI/F²): 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
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II. Instructors

	Academic degree ⁴	Scientific degree	Name and surname	Faculty position (tenure/associate - organization)
Course	Prof.	Dr.	Nicoleta DUMITRASCU	tenure
Seminar				
Laboratory	Teaching assist.	Dr	Ionut Topala	tenure

III. Prerequisites

- Anatomy and biochemistry – generalities
- Physics of solid state
- Elements of plasma physics

IV. Course objectives

1. Description of classes of biomaterials used in medicine and specific requirements.
2. Understanding of the concept of biocompatibility and the methods for biomaterials testing.
3. Knowledge of the methods for biocompatibility improvement and practical aspects of biomedical devices: sterilization, manufacturing, clinical trials and ethical issues, price of implants and allocation of resources.

V. Course content

Course	<ol style="list-style-type: none"> 1. Fundamentals of biomaterials science. Concept of biocompatibility. Classes of biomaterials used in medicine, basic properties, medical requirements and clinical significance. Desinfection and sterilization of biomaterials. 2. Physico-chemical properties of biomaterials: mechanical (elasticity, yield stress, ductility, toughness, strength, fatigue, hardness, wear resistance), tribological (friction, wear, lubricity), morphology and texture, physical (electrical, optical, magnetic, thermal), chemical and biological properties. 3. Elements in contact with the surface of a biomaterial: blood composition, plasma proteins, cells, tissues. 4. Phenomena at the bionterfaces. Molecular and cellular processes with living environment, blood-materials interaction, short and long term reactions to the body. 5. Testing of biomaterials: <i>in vitro</i>, <i>in vivo</i> preclinical and <i>in vivo</i> clinical tests. 6. Technologies of biomaterials processing, as implants and medical devices; improvement of materials biocompatibility by plasma processing.
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¹ FC – fundamental course, SC – specialty course, CC – complementary course

² Co – compulsory, EI – elective, F – facultative

³ C – colloquium, Ex – exam, CE – colloquium AND exam

⁴ Professor / Associate professor / Lecturer / Assistant professor / Teaching assistant

	7. FDA requirements, standards on the biological evaluation of medical devices (ISO-10993) and implications to applications in human. Practical aspects of biomedical devices: manufacturing, storage quality, regulatory and ethical issues, price of implants and allocation of resources.
Seminar	
Laboratory	<p>The practical works (laboratories) are designed to create skills related to the characterization and testing of biomaterials for a specific medical application: biomaterials for hard-tissue replacement, dentistry, biomaterials for soft-tissue replacement, in ophthalmology, heart grafts, biomaterials with specific functions such as membranes for drugs and blood, dialysis, pacemakers etc.</p> <p>New technologies of biomaterials processing will be presented in relation with specific applications: immobilization of biological active species (antibiotics, antibacterial agents, anticoagulants, enzymes), improvement of the materials biocompatibility associated with the blood compatibility and clotting sequences.</p> <p>6 hours are focused on a discussion and detailed presentation of relevant scientific papers, or hypothetical/practical case studies (implants in orthopedic, ophthalmology, sutures etc.). The discussions will largely correspond to the lectures topic and will also include more general topics such as presentation skills and writing.</p>

VI. Minimal required references

1. H.Boenig, *Fundamentals of Plasma Chemistry and Tehnology*, Technomic Publishing Co.Inc. Lancaster Basel, 1990.
2. *Practical Surface Analysis*, 2- edition, Edited by D.Briggs, M.P.Seah, J.Wiley & Sons Ltd, 1990.
3. *Biomaterials Science, An Intoduction to Materials in medicine*, Eds. B. D. Ratner and A. S. Hoffman, Academic Press, New York, 1996.
4. *Plasma-surface modification of biomaterials*, P.K.Chua, J.Y.Chena, L.P.Wanga, N.Huang, Elsevier Science B.V, 2002.
5. XXX – Articles about *Biomaterials and Biocompatibility*.

VII. Didactic methods

Lectures, discussions, practical work, didactic films.

VIII. Assessment

Pre-conditions	Attendance (30% from the final grade), active participation to class activities	
Exam dates	1st Assessment	8th week
	2nd Assessment	16th week

	Assessment means and methods	Percentage of the final grade
Exam/Colloquium	Written paper	50%
Seminar	Presentation of a research project	30%
Laboratory	Practical work	20%