

Biomedicine Environmental Nanotechnology

HEALTH SCIENCES			
FACULTY	HEALTH SCIENCES		
DEPARTMENT	NURSING		
LEVEL OF EDUCATION	UNDERGRADUATE		
LESSON CODE	0805.5.011.0	SEMESTER OF STUDIES	5 th
COURSE TITLE	BIOMEDICINE ENVIRONMENTAL NANOTECHNOLOGY		
SELF-ENDED TEACHING ACTIVITIES		HOURS OF TEACHING / WEEK	CREDIT UNITS
Theory		1	
Coaching school			
Laboratory		1	
Clinical exercise			
Total		2	3
COURSE TYPE:		ELECTIVE COMPULSORY	
PREREQUISITE COURSES:		NO	
LANGUAGE OF TEACHING and EXAMINATIONS:		Greek	
THE COURSE IS OFFERED TO ERASMUS STUDENTS:		NO	
WEBSITE COURSE		https://eclass.hmu.gr/courses/NURS228/	
Learning results			
<p>The course aims to introduce students in a niche technology related to the development of polymeric composites incorporating nanomaterials, ideal for biomedical and/or environmental applications, including innovative drug delivery systems, tissue engineering, bioprinting, development of antipathogen coatings, surgical implants and medical equipment monitoring in health and therapeutic structures. In addition, the students will learn about water filtration and treatment technologies (desalination and pharmaceutical wastes adsorption), air purification technologies, as well as their impact on human health.</p> <p>After completing the course, students will be able to:</p> <ul style="list-style-type: none"> • understand the materials' properties in nanoscale and their applicability towards the improvement of conventional medical monitoring applications and diseases treatment • categorize nanostructured materials depending on their properties • know the existence of novel advanced materials and the capability of incorporation in biomedical applications, including innovative drug delivery systems, tissue engineering, bioprinting, development of antipathogen coatings, surgical implants and medical equipment monitoring in health and therapeutic structures • know innovative techniques against various cancer types 			

<ul style="list-style-type: none"> • describe the fundamentals and the experimental route of hybrid drug delivery and targeted release nanosystems development and to anticipate their benefits against the conventional ones • know simple and more complicated <i>in vivo</i> and <i>in vitro</i> evaluation techniques in terms of materials' biocompatibility/toxicity • develop polymeric nanocomposites for biomedical and environmental applications • describe novel water and air purification and treatment techniques, as well as the impact on human health 	
General Skills	
Search, analysis and synthesis of data and information using the appropriate technology; Adaptability in new situations; Decision making; autonomous working skills; collaborative working skills; Working under an international environment; Working under an interdisciplinary environment; New ideas production; Projects' design and management; Respect in nature; provision of independent and critical thinking	
Course content - Theory outline	
1 st week	Introduction to the history of Biomedical Science and Technology
2 nd week	Introduction to Polymers - classification - Biopolymers
3 rd week	Introduction to Nanomaterials
4 th week	Novel 2D/layered Materials of interest properties – Incorporation in biomedical applications
5 th week	Spectroscopic and other characterization techniques of nanomaterials and composites
6 th week	Biocompatibility – Toxicity and characterization Techniques (<i>in vitro</i> , <i>in vivo</i>)
7 th week	Nanocomposites development – Techniques
8 th week	Regulation factors of the properties of nanocomposites
9 th week	Innovative biomedical applications incorporating nanomaterials - bioimplants (Nanomaterials for diagnosis and treatment of cancer, tissue engineering and 3D bioprinting, drug delivery systems)
10 th week	Innovative environmental applications incorporating nanomaterials
11 th week	Water desalination/treatment technologies and pharmaceutical wastes adsorption
12 th week	Air purification technologies – Impact on human health
13 th week	Recycling – reuse – environmental fingerprint/impact on human health
Course content - Lab outline	
1 st week	Familiarization with the lab equipment – Safety and hygiene
2 nd week	Preparation – Materials, reagents and standard samples handling and management - Samples labeling/encoding – Storage conditions
3 rd week	Development of aqueous dispersion – stabilization – Determination of the concentration by physical and spectroscopic techniques
4 th week	2D materials modification using natural products
5 th week	Polymeric nanocomposites development techniques, coatings and thin films
6 th week	Fundamentals of spectroscopic characterization of biocompatible materials
7 th week	Hydrogels development – regulation of the composition
8 th week	In vivo – in vitro biocompatibility evaluation techniques – Materials toxicity
9 th week	Implants development by 3D printing
10 th week	Development of air purification antibacterial filters
11 th week	Development of water purification/treatment filters
12 th week	Water quality evaluation
13 th week	FINAL EXAM

TEACHING and LEARNING METHODS - EVALUATION	
TEACHING METHOD	<p>Theory</p> <ol style="list-style-type: none"> 1) Traditional lectures using power-point software 2) Video conference 3) Discussion with students <p>Lab</p> <ol style="list-style-type: none"> 4) In person 5) Execution/demonstration of experiments
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES	Slides show. Video view. Use of the e-class electronic platform to store presentations in digital format for easy access by students. Communication with students on issues related to the educational process through the same platform
TEACHING ORGANIZATION	<p>Activity Semester workload 90</p> <p>Lectures (total 13x1)</p> <p>Lab (Total 13x1)</p> <p>Total course (13x2) = 26</p>
STUDENT EVALUATION	<p>Η τελική βαθμολογία του μαθήματος:</p> <ol style="list-style-type: none"> 1) 40% from a written final exam in theory content 2) 40% from a written final exam in Lab content 3) 20% from a bibliographic homework
RECOMMENDED BIBLIOGRAPHY (into Greek language)	
<p>THEORY</p> <ol style="list-style-type: none"> 1. Electronic teacher's notes on e-class 2. Τυποποιημένες ασκήσεις του διδάσκοντα 3. Malsch, N.H., "Biomedical Nanotechnology", CRC Press. (2005) 4. Mirkin, C.A. and Niemeyer, C.M., "Nanobiotechnology II: More Concepts and Applications", Wiley-VCH. (2007) 5. Lamprecht, A., "Nanotherapeutics: Drug Delivery Concepts in Nanoscience", Pan Stanford Publishing Pte. Ltd. (2009) <p>LAB</p> <ol style="list-style-type: none"> 1) Electronic teacher's notes on e-class 2) Recommended manuals 	