

## COURSE OUTLINE

### 1. GENERAL

<b>SCHOOL</b>	AGRICULTURAL SCIENCES		
<b>ACADEMIC UNIT</b>	FOOD SCIENCE AND TECHNOLOGY		
<b>LEVEL OF STUDIES</b>	UNDERGRADUATE		
<b>COURSE CODE</b>	<b>FST_X10</b>	<b>SEMESTER OF STUDIES</b>	Winter
<b>COURSE TITLE</b>	NANOTECHNOLOGY AND BIOMATERIALS IN FOOD PRODUCTION		
<b>INDEPENDENT TEACHING ACTIVITIES</b> <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>		<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS</b>
Lectures and seminars		4	5
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
<b>COURSE TYPE</b> <i>general background, special background, specialised general knowledge, skills development</i>	Elective specialised general knowledge		
<b>PREREQUISITE COURSES:</b>	Typically, there are not prerequisite course.		
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	Greek / English		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	Yes		
<b>COURSE WEBSITE (URL)</b>	<a href="https://eclass.upatras.gr/">https://eclass.upatras.gr/</a>		

### 2. LEARNING OUTCOMES

<p><b>Learning outcomes</b> <i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> <li>• <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i></li> <li>• <i>Descriptors for Levels 6, 7 &amp; 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i></li> <li>• <i>Guidelines for writing Learning Outcomes</i></li> </ul>
<p>The course aims at learning and understanding the concepts of Nanotechnology, biomaterials as well as understanding the applications of nanotechnology and nanoulites in the food industry</p> <p>Upon successful completion of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• acquiring knowledge of the basic principles of nanotechnology in the food sector</li> <li>• the mathematical ability to describe the phenomena of these scientific fields</li> <li>• introduction to biomaterials and their applications in food and health sciences</li> <li>• discussion, critical analysis, synthesis of opinions and suggestions on bioethics problems</li> <li>• Introduction to reading, understanding and critical evaluation of international scientific literature</li> </ul>
<p><b>General Competences</b> <i>Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?</i></p> <p><i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i>                      <i>Project planning and management</i> <i>Respect for difference and multiculturalism</i></p>

<i>Adapting to new situations</i>	<i>Respect for the natural environment</i>
<i>Decision-making</i>	<i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i>
<i>Working independently</i>	<i>Criticism and self-criticism</i>
<i>Team work</i>	<i>Production of free, creative and inductive thinking</i>
<i>Working in an international environment</i>	.....
<i>Working in an interdisciplinary environment</i>	<i>Others...</i>
<i>Production of new research ideas</i>	.....

Generally, by the end of this course the student will have developed the following general abilities (from the list above):

- Autonomous (Independent) work
- Adapting to new situations
- Promotion of free, creative and inductive thinking
- Respect for the food safety
- Project planning and management

### 3. SYLLABUS

#### Nanotechnology

Introduction: Natural Nanostructures in Food. Possible Benefits and Incentives for the Market Acceptance of (Bio) Nanotechnology in the Agriculture and Food Sector by Consumers. The Psychology of Food Selection: Aligning Emerging Food Technologies.

- Public Consciousness of Nanotechnologies: A Commitment on Nanotechnology in Food. Quantitative Opinion Polls. Quality Polls of the Common Opinion. Ambiguous and Dedicated Opposition to Nano (Bio) Technology. Public Consultation, Dialogue, Participation, Engagement, etc. Settlement Issues. Possible Way Forward.

- Artificially Manufactured Nanomaterials (ENPs): Inorganic Artificially Manufactured Nanomaterials.

Organic Artificially Crafted Nanomaterials. Surface Artificially Manufactured Nanomaterials.

- Applications of Nanotechnology for Food Ingredients, Supplements and Additives: Current Status of Nanotechnologies and Future Trends. Current and Planned Applications. Nanomaterials for Food (Health) Applications. Nanoprecipitation. Polymeric nanoparticles. Transfer of bioactive substances.

- Nanotechnologies in Food Packaging: Improvement of Engineering Properties through Nanosynthetics. Improvement of Barrier Properties. Improving the Performance of Bio-based Polymers. Surface Biocides. Active Packaging Materials. Smart Packaging Ideas. Nanosensors for Food Quality. Edible nano overlays. Possible Nanoparticle Movement from Food Contact Materials

- Other Applications of Nanotechnology in Food: Analytical Nanotechnology. Nanoemulsions. Biotechnology in Food Industry. Nanofiltration.

- Possible Risks of NanoFood for Consumers: Gaps in Knowledge for Estimation Risk of Nanotechnologies in Food. Consequences of Risk Analysis of ENPs.

#### Biomaterials

- Biomaterials: Materials Science. Surface properties. Polymers. Hydrogels. Natural materials.

Metals. Ceramics. Complex materials.

- Biological applications: Responses of the organism in biomaterials. Assessment of

#### 4. TEACHING and LEARNING METHODS - EVALUATION

<p><b>DELIVERY</b> <i>Face-to-face, Distance learning, etc.</i></p>	Lectures face to face.	
<p><b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b> <i>Use of ICT in teaching, laboratory education, communication with students</i></p>	Use of Information and Communication Technologies (ICTs) (e.g. powerpoint) in teaching. The lectures content of the course for each chapter are uploaded on the internet, in the form of pdf files, where from the students can freely download them using a password which is provided to them at the beginning of the studies.	
<p><b>TEACHING METHODS</b> <i>The manner and methods of teaching are described in detail.</i> <i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i></p> <p><i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></p>	<p><b>Activity</b></p>	<p><b>Semester workload</b></p>
	Lectures (3 conduct hours per week x 13 weeks)	39
	Seminars (1 conduct hour per week x 13 weeks)	13
	work on an assignment	16
	Final examination (3 conduct hours)	3
	Hours for private study of the student	54
	Total number of hours for the Course (25 hours of work-load per ECTS credit)	125 hours (total student work-load)
<p><b>STUDENT PERFORMANCE EVALUATION</b> <i>Description of the evaluation procedure</i></p> <p><i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	<p>1. Written examination after the end of the semester. The mark constitutes the 75% of the final grade (<math>G_{75\%}</math>).</p> <p>2. Assignment provided during the term. The mean mark constitutes the other 25% of the final grade (<math>G_{25\%}</math>).</p> <p>The final grade for the course is calculated by the final grade in the assignment (25%) and the grade of the final written examination (75%).</p>	

#### 5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Chaudhry Q., Castle L., Watkins R.: Nanotechnologies in Food. Editions RSC Publishing, 2010
- Huang Q.: Nanotechnology in the Food, Beverage and Nutraceutical Industries. Editions

- **Woodhead Publishing, 2012**
- **National Research Council: Nanotechnology in Food Products: Workshop Summary. The National Academies Press, 2009**
- **Shetty K., Paliyath G., Pometto A., Levin R.: Food Biotechnology. Editions CRC/Taylor & Francis, 2006**