MASTER`S PROGRAMME

CLINICAL CHEMISTRY

1ST YEAR OF STUDY, 2ND SEMESTER

COURSE TITLE	*NANO AND BIOMATERIALS*
COURSE CODE	31010030002PM1211202
COURSE TYPE	full attendance/ tutorial
COURSE LEVEL	2nd cycle (Master's degree)
YEAR OF STUDY, SEMESTER	1st year of study,2nd semester
NUMBER OF ECTS CREDITS	6
NUMBER OF HOURS PER WEEK	4 (2 lecture hours + 2 laboratory practice)
NAME OF LECTURE HOLDER	Assoc. Prof. PhD Maria IGNAT
NAME OF SEMINAR HOLDER	Assoc. Prof. PhD Maria IGNT
PREREQUISITES	Advanced level of English

A	**GENERAL AND COURSE-SPECIFIC COMPETENCES**
	General competences: - Developing skills of study and research on biocompatible nanomaterials, a complex and interdisciplinary field of major importance for maintaining and/or improving health; - Developing skills for practical implementation of theoretical concepts and experimental techniques for the synthesis and characterization of biocompatible nanomaterials. **Course-specific competences**: Upon successful completion of this discipline, students will be able to: - Describes the principles and conditions specific to the syntheses, as well as the methods of characterization of biocompatible materials, as well as the way of recovery / purification of products and / or waste. - Use the notions introduced in the course in a broader context in terms of general training as a chemist with potential employment in medical analysis laboratories / pharmaceutical laboratories. - Critically analyze the quality of the data obtained about the characteristics of biocompatible nanomaterials, making comparisons and optimizations. - Make experimental determinations, systematize and interpret experimental results. - Communicates effectively notions related to the specifics of the discipline, transfers the knowledge gained through oral or written communication. - To integrate in a working group in which activities are performed that involve synthesis / processing / characterization of biocompatible nanomaterials. - Act responsibly and autonomously for specific tasks related to the use and analysis of biocompatible materials.
B	**LEARNING OUTCOMES**
	Remembering the nanoscale concept, size effect on materials properties, materials classification, nanomaterials functionalities, classification of biocompatible nanomaterials; Understanding the discipline-specific concepts, methods for synthesizing biocompatible nanomaterials; Applying the synthesized materials at nanoscale level in different areas; Analyzing structural, morphological and textural characteristics of synthesized biocompatible nanomaterials, as well as establishing their properties, analyze, categorize, compare, differentiate;

	Evaluating interdisciplinary logical connection with physics, biology, biochemistry, toxicity, environmental science and communicate the accumulated knowledge; Creating/proposing nanostructures of various materials to be useful in various domains of applications.
C	**LECTURE CONTENT**
	Materials science at "nano" scale: nanoscale concept, size effect on materials properties, materials classification. Nanomaterials functionalities: biocompatibility, bioactivity, biodegradation. Classification of biocompatible nanomaterials: natural (soft, hard nanobiomaterials, cells), synthetic (metallic, polymeric, ceramic, composite nanobiomaterials), hybrid (natural/natural, natural/synthetic nanobiomaterials). Synthetic methods, properties and specific characterization techniques for biocompatible nanomaterials. standardization of a nanobiomaterial. Reference standard nanobiomaterial. Potential risks of nanobiomaterals: during fabrication, during administration. "*In vivo*" and "*in vitro*" biocompatibility evaluation. Potential application of biocompatible nanomaterials: drug delivery, tissue engineering, micro-electro-mechanic biological systems. Examples of biocompatible nanomaterials with actual practical applications: mesoporous silica, "core-shell" nanoparticle, carbon nanomaterials.
D	**RECOMMENDED READING FOR LECTURES**
	1. G.Q.Lu, X.S.Zhao – Nanoporous Materials Science and Engineering, Imperial College Press, London, 2004. 2. Nalva, Hari Singh - Nanostructured Materials and Nanotechnology, Academic Press, 2002. 3. Yuri Gogotsi - Handbook of Nanomaterials, CRC Taylor & Francis Group, 2006. 4. Stamatin I., Nanomateriale aplicații în biosenzori, surse de energie, medicină biologie, Ed. UNIVERSITATEA DIN BUCUREŞTI, 2008. 5. Vasile A., Materiale nanostructurate avansate. Prezent şi viitor. Vol. II: Materiale nanoporoase, Casa Ed. Demiurg, Iaşi, 2009. 6. H.A.Khan, M.K.Sakharkar, A.Nayak, U.Kishore, A.Khan, Nanoparticles for biomedical applications: An overview, Nanobiomaterials Nanostructured Materials for Biomedical Applications 2018, Pages 357-384 7. Sumistha Das, Shouvik Mitra, SM Paul Khurana, SM Paul Khurana, Nitai Debnath, Nitai Debnath, Nanomaterials for biomedical applications, 2013 Frontiers in Life Science 7(3-4) 8. Ramos, Ana P et al. “Biomedical applications of nanotechnology.” Biophysical reviews vol. 9,2 (2017): 79-89. doi:10.1007/s12551-016-0246-2
E	**SEMINAR CONTENT**
	1. Notions of occupational safety and health and laboratory fire protection. Synthesis of mesoporous hydroxyapatite ordered by the hydrothermal sol-gel method (first stage of synthesis). 2. Post-synthesis heat treatment of ordered mesoporous hydroxyapatite and preparation for characterization (second stage of synthesis) 3. Textural characterization of synthesized mesoporous hydroxyapatite. Registering the nitrogen adsorption / desorption isotherms. 4. Processing the numerical data from the acquired nitrogen adsorption / desorption isotherms; graphical representation of isotherms and pore size distribution; evaluation of the specific surface area, total pore volume, microporosity, average pore diameter. Interpretation of the results obtained by study compared with data from the literature. 5. Loading of the synthesized hydroxyapatite with active principle and its release in a simulated biological fluid. 6. Assessment of active load capacity. Assessment of the controlled release capacity of the active ingredient. Comparison of the loading and release capacities of synthesized hydroxyapatite with similar materials reported in the literature. 7. Brief examination from laboratory activity: establishing the design of the individual activity report (data sources, analysis methods, data volume, necessary and available resources, selection of bibliographic references). Presentation of the individual activity reports elaborated on the basis of the experimental observations made, of the processed of the acquired data and of the literature studies carried out by the students.

F	**RECOMMENDED READING FOR SEMINARS**
	1. M. Ignat – flyer reports 2. Various technical brochures forf biocompatible nanomaterials
G	**EDUCATION STYLE**
LEARNING AND TEACHING METHODS	Lectures supported by multimedia teaching techniques (images, video). Type classes will be interactive lecture using PowerPoint presentation of information accompanied by a large number of images suggestive themes lecture.
ASSESSMENT METHODS	Forms: continuous assessment Final score: 50% continuous assessment of the students` theoretical knowledge; 50% continuous assessment of the students` practical application Minimum score for each form of assessment is 5
LANGUAGE OF INSTRUCTION	Romanian English