

Name of the course	Functional polymer materials
Number of instruction hours	20
Outline of course/module content	<p>Advanced technologies for functionalization of nanoparticles (NPs): preparation of functional polymer blends and polymer nanocomposites for biomedical applications (biosensing, drug delivery), membrane separation processes (permeability) and catalyst carriers (waste water treatment). Nanoparticles (NPs) - size-dependent physical and chemical properties. Surface functionalization of NPs by introducing natural biopolymers in the systems due to biological compatibility. Methods for functionalization of NPs: a thin film hydration including sonication process, solvent exchange method.</p> <p>Applications of polymer nanotechnology in food packaging materials - improved mechanical, barrier and antimicrobial properties, - tracing and monitoring the food condition during transport and storage by nano-sensors. Functional polymer nanomaterials for food packaging (PNFP) - multilayer films - coatings or standalone films, - nano-biocomposites. Biobased and renewable materials: chitosan (CS), polycaprolactone (PCL), poly(lactic acid), (PLA): health safety, biodegradability, stability.</p> <p>Functional applications with the presence of nanoparticles:</p> <ul style="list-style-type: none"> • “Improved” PNFP – improvement of the packaging properties: polymer-flexibility, gas barrier properties, temperature/moisture stability; • “Active” PNFP – packaging interaction with food and the environment; dynamic role in food preservation; • “Intelligent” PNFP –monitoring of the packed food condition and/or the food environment. <p>Introduction to biosensors; Types of biosensors; DNA sensors; Enzyme-based sensors; Immunosensors; Polymers in biosensing; Biological molecules immobilisation techniques; Polymer coatings in biosensing; Electrically conducting polymers (ECP) in biosensors; Readout modalities in ECP biosensors and Applications; Conjugated photoluminescent polymers in biosensing, homogeneous and heterogeneous sensors and Applications; Sol-gel and hydrogel material in biosensors; Recent developments and examples.</p>
Description of instruction methods	Lectures, Preparation of seminar and presentation
Description of course/module requirements	Written and oral exam