Univerza v Mariboru

Fakulteta za naravoslovje in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	**Fizika polimerov**
Course title:	**Physics of polymers**

Študijski program in stopnja Study programme and level	Študijska smer Study field	Letnik Academic year	Semester Semester
FIZIKA		1. ali 2.	**1., 2. ali 4.**
PHYSICS		1. or 2.	**1., 2. or 4.**

Vrsta predmeta / Course type	Izbirni za vse module
Univerzitetna koda predmeta / University course code:	

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Terenske vaje Field work	Samost. delo Individ. work	ECTS
10	**5**				**165**	**6**

Nosilec predmeta / Lecturer:	**Lea Spindler**

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian
	Vaje / Tutorial:	slovenski/Slovenian in/and angleški s slovenskim prevodom/English with translation in Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisits:**
Priporočljivo je predznanje s področij fizike mehke snovi, fizike materialov in statistične termodinamike	Preknowledge from the following fields of physics is recommended: soft matter physics, physics of materials and statistical thermodynamics

Vsebina:

Osnove polimerov
- osnovne definicije, konfiguracije polimernih verig, modeli za masno porazdelitev

Statistična termodinamika polimernih raztopin
- splošne termodinamske zveze, entropija mešanja, razredčene polimerne raztopine

Fazno ravnovesje v polimernih sistemih
- fazno ravnovesje v polimernih tekočinah in kristalih

Polimeri s kompleksno strukturo
- polimerne mešanice, sestavljeni linearni in zvezdasti sistemi, interakcijski parameter

Lastnosti raztopin in metode za karakterizacijo
- masna porazdelitev, viskoznost, osmotski pritisk, difuzija, mikrofazna separacija
- sipanje vidne in rentgenske svetlobe, sipanje nevtronov, cirkularni dikroizem, elektronska mikroskopija, jedrska magnetna resonanca, elektronska in IR spektroskopija,

Polimeri na površinah in metoda za karakterizacija
- termodinamika prostih površin, površinska napetost, urejanje v tankih plasteh
- elektronska mikroskopija, mikroskopija na atomsko silo

Pomembnost in uporaba polimerov

Content (Syllabus outline):

Polymer basics
- primary definitions, configuration of polymer chains, models of molecular weight distributions

Statistical thermodynamics of polymer solutions
- general thermodynamic relations, entropy of mixing, dilute polymer solutions

Phase equilibria in polymer systems
- phase equilibria in liquid and crystalline polymer systems

Polymers with complex structure
- polymer blends, block copolymers with linear and starlike geometries, interaction parameters

Solution properties and characterisation
- mass distributions, viscosity, osmotic pressure, diffusion
- light scattering, x-ray and neutron scattering, circular dichroism, electron microscopy, nuclear magnetic resonance, electronic and infrared spectroscopy

Polymer on surfaces and characterisation
- thermodynamics of free surfaces, surface tension, ordering in thin films
- electron microscopy, atomic force microsopy (AFM)

Modern applications and use of polymers

Temeljni literatura in viri / Readings:

1) S.F. Sun: Physical Chemistry of Macromolecules (John Wiley & Sons, New York, 1994)
2) R.J. Young, P.A. Lovell: Introduction to Polymers, 3rd edition (CRC Press, Boca Raton, 2011)
3) L.H. Sperling, Introduction to physical polymer science, 4th edition (Wiley-Interscience, 2006).
4) M. Doi, S.F. Edwards: The Theory of Polymer Dynamics (Oxford University Press, New York, 2001)
5) J. Israelachvili, Intermolecular and Surface Forces, 3rd edition (Academic Press, San Diego, 2011)

Cilji in kompetence:	**Objectives and competences:**
Študenti poglobijo znanje s področja polimernih sistemov in dobijo pregledno znanje o eksperimentalnih metodah, teoretičnih modelih in moderni uporabi polimerov.	Students acquire a deeper knowledge on polymer systems and gain an overview of experimental methods, theoretical models and applications of polymers.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje fizikalnih pojavov iz področja polimernih sistemov Prenesljive/ključne spretnosti in drugi atributi: Različni eksperimentalni pristopi, računske metode za opis polimerov in celoten pristop k reševanju problemov.	Knowledge and understanding: Knowledge and understanding of physical laws in polymer systems Transferable/Key Skills and other attributes: Different experimental techniques, numerical methods for describing polymers, and an integral approach to problem solving

Metode poučevanja in učenja:	**Learning and teaching methods:**
Metodika obsega teoretičen uvod v obravnavano snov in reševanje posameznih problemov.	They are based on theoretical introduction and on solving of specific problems.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt)		Type (examination, oral, coursework, project):
ustni izpit	**50%**	oral exam
seminar	**50%**	seminar

Reference nosilca / Lecturer's references:

1. ČOGA, Lucija, SPINDLER, Lea, MASIERO, Stefano, DREVENŠEK OLENIK, Irena. Molecular recognition of a lipophilic guanosine derivative in Langmuir films at the air-water interface. *Biochimica et biophysica acta (G). General subjects*, ISSN 0304-4165. [Print ed.], 2017, vol. 1861, iss. 5, part B, str. 1463-1470, ilustr., doi: 10.1016/j.bbagen.2016.11.038. [COBISS.SI-ID 3041636]

2. TROHA, Tinkara, DREVENŠEK OLENIK, Irena, WEBBA DA SILVA, Mateus, SPINDLER, Lea. Surface-adsorbed long G-quadruplex nanowires formed by G:C linkages. *Langmuir*, ISSN 0743-7463, 2016, vol. 32, iss. 28, str. 7056-7063, ilustr., doi: 10.1021/acs.langmuir.6b01222. [COBISS.SI-ID 2971236]

3. HESSARI, Nason Ma'ani, SPINDLER, Lea, TROHA, Tinkara, LAM, Wan-Chi, DREVENŠEK OLENIK, Irena, WEBBA DA SILVA, Mateus. Programmed self-assembly of a quadruplex DNA nanowire. *Chemistry*, ISSN 0947-6539. [Print ed.], 2014, vol. 20, issue 13, str. 3626-3630,

ilustr. http://onlinelibrary.wiley.com/doi/10.1002/chem.201300692/full, doi: 10.1002/chem.201300692. [COBISS.SI-ID 2644580]

4. ILC, Tina, ŠKET, Primož, PLAVEC, Janez, WEBBA DA SILVA, Mateus, DREVENŠEK OLENIK, Irena, SPINDLER, Lea. Formation of G-wires : the role of G:C-base pairing and G-quartet stacking. *The journal of physical chemistry. C, Nanomaterials and interfaces*, ISSN 1932-7447, 2013, vol. 117, iss. 44, str. 23208-23215, ilustr., doi: 10.1021/jp4019348. [COBISS.SI-ID 2606436]