Lecture title	Selected issues from the physics of liquid crystals
Venue	Institute of Molecular Physics Polish Academy of Sciences
Language	polish
Learning objectives	PhD student: 1. Gain knowledge about the classification and basic physical properties of liquid crystals. 2. Learns methods of studying the physical properties of liquid crystals. 3. Learns the basic applications of liquid crystals. 4. Gains knowledge about ultra-thin layers at the interface (Langmuira, Langmuira-Blodgett and Langmuira-Schaefer'a layers). 5. After the course, the PhD student can: (i) determine the classification of liquid crystals, (ii) describe the methods used to study the properties of liquid crystals, (iii) describe the polarizing microscopy method, (iv) discuss the most important applications of liquid crystals, (v) discuss the methods of production and the prospects for the use of ultra-thin layers at the interface, (vi) indicate and describe methods of characterization of layers at the interface.
Course type	Facultative
Term/Year	summer semester 2021/2022
Lecturer's names	dr inż. Natalia Bielejewska dr inż. Sławomir Pieprzyk
Examiner's names	dr inż. Natalia Bielejewska dr inż. Sławomir Pieprzyk
Teaching methods	Lectures with audiovisual techniques
Attendance requirements	Basic knowledge of the general physics, especially soft matter
Number of ECTS points	2 ECTS
Number of lectures	12 h
Balance of ECTS points	One ECTS credit corresponds to 6 hours of lecture and 4 hours of individual work of a PhD student related to learning of material presented during lectures.
Didactic methods	Lectures with the use of current audiovisual techniques.
Methods of verification and assessment of learning outcomes	Written exam, individual discussion of the exam results.
Conditions of a positive evaluation	Positive score st the exam.
Course content	Liquid crystals: - historical introductions - mesomorphic states of substances - physical properties of liquid crystals - liquid crystal classification

	- applications of liquid crystals; LCD, varnishes, thermography, military Basic processes at the interface - molecular adsorption at the interface. Physical phenomena occurring during the formation of monolayers and intermolecular interactions - Langmuir, Langmuir-Blodgett, Langmuir-Schaefer layers and techniques Polarizing microscopy: - structure and operation of the microscope, - thermostatting, - liquid crystal textures, - liquid crystal blue phases. Microscopic methods of liquid crystal texture analysis: - stereology, Voronoi diagram, - colour analysis. Gaining basic physical properties from the analysis of liquid crystal textures.
Literature constituting the course materials	1. A. Adamczyk, Niezwykły stan materii Ciekłe kryształy (Wiedza Powszechna, Warszawa, 1981) 2. Ed. by Hans-Dieter Koswing, Selected Topics in Liquid Crystal Research (Akademie-Verlag Berlin, 1990) 3. J. Żmija, J. Zieliński, J. Parka, E. Nowinowski-Kruszelnicki, Displeje Ciekłokrystaliczne (PWN, Warszawa, 1993) 4. P.G de Gennes, J. Prost, The physics of Liquid Crystals (Clarendon Press, Oxford, 1993). 5. J. Ryś, Stereologia materiałów, Fotobit Design, Kraków (1995). 6. R.M. Haralick, K. Shanmugam, I. Dinstein, Textural Features for Image Classification, IEEE Transactions on Systems, Man, and Cybernetics, Institute of Electrical and Electronics Engineers (IEEE), SMC-3, 610-621 (1973). 7. Q. Wu, F.A. Merchant, K.R. Castleman, Microscope Image Processing, Elsevier (2008). 8. A. Chyla, Warstwy Langmuira-Blodgett i ich wykorzystanie w elektronice molekularnej (Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2004).