

Study programmes: Astronomy and Astrophysics - PhD studies				
Course name: Astrochemistry				
Lecturers: Anđelka Kovačević				
Status: Optional				
ECTS: 9				
Attendance prerequisites: None				
Course aims: Familiarization with methods and problems of physical chemistry and astronomy.				
Course outcome: Students are able to use methods of physical chemistry and astrophysics and to apply to research of chemistry of Universe.				
Course content: The molecular universe. The Standard Model – Big Bang theory. Galaxies, stars and planets. Origins of life. Other intelligent life. Theories of the origin of life. Atomic and molecular astronomy. Spectroscopy and the structure of matter. Line shape. Atomic spectroscopy. Molecular astronomy. Molecular masers. Detection of hydrogen. Diffuse interstellar bands. Spectral mapping. Stellar chemistry. The interstellar medium. Mapping clouds of molecules. Molecules in the interstellar and circumstellar medium. Physical conditions in the interstellar medium. Rates of chemical reactions. Chemical reactions in the interstellar medium. Photochemistry. Charged particle chemistry. Polycyclic aromatic hydrocarbons. Dust grains. Chemical models of molecular clouds. Prebiotic molecules in the interstellar medium Planetary chemistry. Structure of a star – planet. Surface gravity Formation of the Earth. Earth – Moon system. Geological periods Radiative heating. The habitable zone. Extrasolar planets. Planetary atmospheres. Atmospheric photochemistry. Biomarkers in the atmosphere Carbon- and water-based life forms. Spontaneous chemical reactions Rates of chemical reactions. Endogenous production of organic molecules. Exogenous delivery of organic molecules. Homochirality Surface Metabolism – ‘clay organisms’ . Geothermal Vents – ‘black smokers’ . RNA World hypothesis. Self-assembly and encapsulation. Protocells. Universal tree of life. Astrobiology. Microbial Mars . Physical properties. The atmosphere. Temperature-dependent chemistry. Energy balance and the greenhouse effect. Atmospheric chemistry Astrobiology on Titan.				
Literature:				
1. A.M. Shawn: Astrochemistry, Wiley & Sons, 2006				
2. Scripts of A. Kovačević				
Number of hours: 10	Lectures: 4	Tutorials: 6	Laboratory: -	Research: -
Teaching and learning methods: Frontal / Group / Practical				
Assessment (maximal 100 points)				
Course assignments	points	Final exam	points	
Lectures	4	Written exam	-	
Exercises / Tutorials	-	Oral exam	-	
Term paper 1	18	Written-oral exam	60	
Term paper 2	18			