Study program	Level of studies		First cycle	
	Study program name		**Physics Education**	
Course name	**SELECTED TOPICS IN MODERN PHYSICS II**			
Course ID	Semester	Course status	ECTS credits	L+E
PTH6612	**VI**	**MANDATORY**	**7**	**3+3**
Lecturer				
Aims and intended learning outcomes	The goal of the course is to provide students with a basic knowledge of modern physics (20th century physics), its postulates, results and applications, especially in the areas of statistical physics, molecular physics, laser physics, condensed matter physics, elementary particle physics and astrophysics. It is expected that a student who passes the course will be able to: - Describe basic classical and quantum-mechanical state distribution functions. - Explain the fundamentals of molecular bonds, the principles of laser operation, and their applications. - Analyze physical models of conductors and semiconductors, understanding their differences and applications. - Describe the basics of the Standard Model, the physics of the Sun, stars, and galaxies.			

Course content

Classical statistics: Boltzmann distribution, Maxwell distribution, heat capacity for gases and solids. Quantum statistics: Bose-Einstein and Fermi-Dirac distributions. Density of states. Bose-Einstein condensation. Quantization of energy states. Specific heat. Properties of fermionic gases.
Molecular structures and spectra. H2+ molecule, H2 molecule. Polar and nonpolar molecules and their bonds. Energy levels and spectra of diatomic molecules. Scattering, absorption, and stimulated emission. Lasers and masers, development, and types.
Structure of solid bodies. Classical theory of conductivity. Free electron gas model. Quantum theory of conductivity. Magnetism. Kronig-Penney model. Semiconductors. Hall effect. Superconductivity. BCS theory.
Physics of elementary particles. Fundamental interactions and their carriers. Conservation laws and symmetries. Standard Model and possible extensions.
The Sun. Surface and atmosphere of the Sun. Interior of the Sun. Solar energy. Stars and constellations. Classification of stars. Stellar evolution. Galaxies. Hubble's law.

Student workload (hours)		Grading	
Lectures and Exercises	90	Assessment method	Points
Exam preparation	85	Midterm exam	50
Total	175	Final exam	50
		Total	100

Literature

1. Lecture notes
2. Paul A. Tipler, Ralph A. Llewellyn, *Modern physics,* W. H. Freeman and Company, New York, 2012
3. R. A. Serway, C. J. Moses, C. A. Moyer, *Modern Physics*, Thomson Learning, Belmont, 2005
4. D. Halliday, R. Resnick, *Modern Physics,* Wiley, Hoboken, NJ, 2010.

Remarks