Program	Level of studies		**First cycle**	
	Program name		**Educational Physics**	
Course name	**OPTICS**			
Course ID	Semester	Course status	ECTS credits	L+E
PHY4611	**IV**	**MANDATORY**	**6**	**3+2**
Lecturer	**Prof. dr. Mustafa Busuladžić**			
Aims and intended learning outcomes	The goal of this course is to understand the fundamental properties of light propagation and interaction with matter under the approximations of geometrical optics and scalar wave optics. At the end of the course the student should be able to: -state the Fermat’s principle and use it to derive the laws of optics; -derive the mirror and lens equations and use them to solve various problems; -describe the main optical instruments and explain how they work; -explain the properties of the light by using the principles of wave optics; -explain and analyze the interference, diffraction and polarization of light.			

Course content

Fermat's principle and its applications. Ray optics. Paraxial approximation. Rectilinear propagation of light. Reflection and refraction. Total internal reflection. Plane and spherical mirrors. Spherical mirror equation. Object, image, and magnification. Sign convention. Graphical methods. Aspherical mirrors. Dispersion by a prism. Dispersive power. Angular and chromatic dispersions. Combination of prisms. Refraction through a compound slab. Refraction at spherical surfaces. Lateral and longitudinal magnification. Smith-Helmoltz equation and Lagrange law. Abbe's sine condition. Applanatic points.
Lenses. Image tracing and sign convention. Thin lens. Lens maker's equation. Newton's lens equation. Magnification. Power. Optical system and cardinal points. Construction of the image using cardinal points. Thick lenses. Cardinal points of thick lenses. Thick lens equation. Combination of two thick lenses. Lens aberrations. Optical instruments. Photometry.
Wave optics. Propagation of light waves. The Fresnel equations. Polarization of light. Brewster's law. Linear polarization. Malus' law. Anisotropic cristals. Double refraction in crystal. Huygens' explanation of double refraction. Electromagnetic theory of double refraction. Optical indicatrix. Elliptically and circularly polarized light. Analysis of polarized light. Optical activity and Fresnel's explanation. Interference. Young's double slit experiment. Coherence (coherence length and coherence time). Conditions for interference. Techniques for obtaining interference. Interference in thin films. Interference due to reflected light. Conditions for minima and maxima. Interference due to transmitted light. Variable thickness film. Colours in thin films. Newton's rings. Types of diffraction. Fresnel diffraction. Huygens-Fresnel theory. Zone plate. Distinction between interference and diffraction. Fraunhoffer diffraction at a single slit. Fraunhoffer diffraction at a circular aperture. Fraunhoffer diffraction at double slit. Plane diffraction grating.

Student workload (hours)		Grading	
Lectures and Exercises	75	Assessment method	Points
Exam preparation	75	Course Test	50
Total	150	Final Exam	50
		Total	100

Literature

1. Lecture Notes.
2. Eugene Hecht, Optics, fifth ed., Pearson, London, 2016.
3. F. W. Sears, Optika, prijevod trećeg izdanja, Naučna knjiga, Beograd, 1963.
4. F. L. Pedrotti, L. M. Pedrotti, L. S. Pedrotti, Introduction to optics, third ed., Pearson, London, 2014.
5. G. S. Landsberg, Optika, prijevod četvrtog izdanja, Naučna knjiga, Beograd, 1967.

Remarks

Continuous knowledge and skills assessment will be carried out through midterm exams (written tests). Final examination can also be an oral exam. The successful completion of the course implies achieving at least 55% of the total number of points in both the partial and final exam.