Code	VI.6.
Course Title (English)	Engineering Physics-Wave Optics and Contemporary Physics
Course Title (Polish)	Fizyka techniczna – Optyka falowa i wybrane zagadnienia fizyki współczesnej
Credits	4 ECTS

Language of instruction **English**

Compulsory for Profile: Computer Modelling and Simulation (CMS), Intelligent Energy (IE), Biotechnology for Environmental Protection (BI), Business and Technology (BT)

Type of studies BSc studies

Unit running the programme Institute of Physics

***Course coordinator** and academic teachers* **Ryszard Hrabański, Assoc. Prof**., Ryszard Hrabański**,** Assoc**.** Prof., (Lec.), Piotr Pawlik, dr (Tut.)

Form of classes and number of hours

Semester	Lec.	Tut.	Lab.	Proj.	Sem.	Credit points
1	30	-	15	-	-	4

Learning outcomes

The objective of this course is to familiarize students with the principles of optics and modern physics that are often used in today's industry and technical equipment. At work sites, the graduates often need to work with equipment that work by the virtue of modern physics principles. Examples are different measurement devices, electronic and optical equipment, etc. The examples and problems selected for the course give students the necessary knowledge and skills to read and analyse scientific data with proper understanding of the units involved and the type of physical quantity measured. On this basis, after finishing this course, students will be able to:

-describe the straight-line-motion behaviour of light through ray optics using the reflection and refraction phenomena in mirrors and lenses

-realize the use of mirrors and lenses in optical instruments such as microscopes, telescopes, cameras, human eye

-calculate simple problems involving flat and spherical mirrors as well as ray-optics instruments

-explain the wave-like behaviour of light through interference, diffraction, single-slit -diffraction, and multi-source interference phenomena

-describe black-body radiation, the photoelectric effect, the Compton effect, and line spectra of atoms as verifications of particle-like behaviour of light

-explain De Broglie waves, electron diffraction, and the Heisenberg uncertainty principle as well as wave-particle duality

-explain the quantum numbers in atomic structure,

-be able to explain how the laser work, describe the applications of lasers,

-explain the electrical properties of metals, semiconductors and insulators.

Prerequisites

Basic knowledge of elementary mathematics and physics, some elements of differential and integration calculus.

Course description

LECTURE

Reflection and Refraction. Ray Optics, Reflection and Refraction, Total Internal Reflection, The Prism and Dispersion, Images Formed by Plane Mirrors, Spherical Mirrors.
Lenses and Optical Instruments. Lenses, The Simple Magnifier, Camera, The Compound Microscope, Telescopes, The Eye, Lens Maker's Formula.
Wave Optics. Interference, Diffraction, Young's Experiment, Intensity of Double-Slit Patterns, Thin Films, Coherence, Single-Slit Diffraction, Diffraction Gratings.
Early Quantum Theory. Blackbody Radiation, The Photoelectric Effect, The Compton Effect, Line Spectra, Atomic Models, The Bohr Model, Wave-Particle Duality of Light, Bohr's Correspondence Principle.

Fundamentals of Quantum Mechanics. de Broglie Waves, Electron Diffraction, Heisenberg Uncertainty Principle Wave-Particle Duality, Schrodiger's Equation, Barrier Tunneling.
Atoms and Solids. Quantum Numbers of Hydrogen, Spin, Pauli Exclusion Principle, Lasers and Laser Light, How Lasers Work, The Electrical Properties of Solids, Metals, Semiconductors.

TUTORIALS: see lecture content

LABORATORY
During the course of the semester 6 or more laboratory experiments will be performed. For each lab, a separate lab report will be required. The lab report will consist of reporting the results of following instructions handed out for performing the lab.

List of laboratory experiments

1. Acoustic Doppler effect
2. Stirling engine
3. Pohl's pendulum
4. Verification of Malus' Law
5. Verificarion of Stefan-Boltzmann's Law of Radiation
6. Stationary Ultrasonic Waves, Determination of Wavelength
7. Determination of Kerr's Constant
8. Determination of the Verdet's Constant
9. Franck-Herz experiment with Hg-tube

PROJECT
Not applicable

SEMINAR
Not applicable

Form of assessment

Exam

Basic reference materials	1. Set of lecture and laboratory notes (based on literature presented below). Handouts for tutorial classes. 2. Raymond A. Serway, John W. Jewett, Jr. „Physics for scientists and engineers with modern physics”, Thomson/Brooks/Cole, 2007 3. Raymond A. Serway, Clement J. Moses, and Curt A. Moyer, „Modern Physics” Brooks/Cole; 3 ed, 2004 4. Douglas C. Giancoli, „Physics for Scientists and Engineers with Modern Physics and Mastering Physics” , Pearson Education, 2008 5. David Halliday, Robert Resnick Jearl Walker, „Fundamentals of Physics -Extended”, John Wiley 2007 6. Hugh D Young, Roger A Freedman, A Lewis Ford, Sears & Zemansky’s University Physics (with Modern Physics) Addison Wesley Longman 2007 7. Paul Allen Tipler, Gene Mosca, “ Physics for Scientists and Engineers”, W.H. Freeman & Company, 2008 8. Physics. Laboratory experiments. PHYWE Systeme GmbH, 2010
Other reference materials	For Polish-speaking students: 1. V. Acosta, C. L. Cowan, B. J. Grahm „ Podstawy fizyki współczesnej”; PWN W-wa 1980 2. R. Resnick, D. Halliday, J. Walker, „Podstawy fizyki”,t.III-V; PWN W-wa 2008 3. J. Massalski, M. Massalska, „Fizyka dla inżynierów”, cz.1i 2, WN-T W-wa 2006 4. B. Jaworski, A. Dietłaf „Kurs fizyki”, t. III; PWN W-wa 1978 5. I. W. Sawieliew „Wykłady z fizyki”, t. III; PWN W-wa 1978 6. T. Rewaj „Ćwiczenia laboratoryjne z fizyki w politechnice”. PWN W-wa 1978

e-mail of the course coordinator and academic teachers	hrab@wip.pcz.pl
Average student workload (teaching hours + individ.)	3 hours of teaching hours + 3 hours of individual work per week
Remarks:	
Updated on: 04.04.2012	