



Faculty of Health, Science and Technology
Physics

Syllabus

Wave Physics and Optics

Course Code:	FYGA28
Course Title:	Wave Physics and Optics <i>Vågfysik och optik</i>
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:

FYA (Physics)

TKA (Engineering Physics)

Course Approval

The syllabus was approved by the Faculty of Health, Science and Technology 2022-10-10, and is valid from the Spring semester 2023 at Karlstad University.

Prerequisites

Registered for Foundation Course in Mathematics, 7.5 ECTS credits, Calculus and Geometry, 7.5 ECTS credits, and Experimentation and Data Analysis, 7.5 ECTS credits, or equivalent

Learning Outcomes

Upon completion of the course, students should be able to:

- give an account of and solve problems in periodic oscillation, damped oscillation, resonance, and different types of mechanical waves,
- give an account of and use the different models for describing light: the wave, ray, and photon models and their applicability,
- identify and analyse light reflection and refraction and reconstruct reflection and refraction based on the ray model,
- explain refraction using the wave model and apply the model in different contexts,

- explain and analyse sound waves, their creation, and different sources of sound,
- identify wave properties such as wavelength, frequency, phase and phase velocity, and group velocity, and apply the properties to wave phenomena,
- identify and mathematically describe wave phenomena such as interference and diffraction and apply them in different contexts,
- apply wave concepts to physical problems, formulate the problem mathematically, calculate a result, and critically assess the order of magnitude of the result,
- apply knowledge of wave behaviour and particle behaviour to describe the wave-particle duality and estimate its consequences for physical phenomena,
- give an account of and calculate the optical path in systems of lenses and mirrors, and
- give an account of and illustrate the properties and applications of polarised light.

Content

Periodic oscillation, forced oscillation and resonance, the general wave equation and wave velocities.

Descriptions of plane, circular, and spherical waves, and mechanical and electromagnetic waves.

Wave properties: wavelength, frequency, phase, phase velocity and group velocity, frequency analysis, and wave packet.

The doppler effect and everyday phenomena of sound and light, human hearing and musical instruments.

Reflection, superposition, standing waves, double slits experiments, interference, diffraction grating, single slit diffraction, refraction, and dispersion.

Imaging with systems of lenses and mirrors, polarised light, the human eye, optical aids and instruments.

Instruction is in the form of lectures, exercises, and mandatory laboratory sessions.

Reading List

See separate document.

Examination

Assessment is based on written exams and laboratory reports. Laboratory attendance is mandatory.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades

One of the grades U (Fail), 3 (Pass), 4 (Pass with Some Distinction), or 5 (Pass with Distinction) is awarded in the examination of the course.

Quality Assurance

Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate

A course certificate will be provided upon request.

Additional information

The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.