



**Karolinska  
Institutet**

Course syllabus for

## **Optics of the human eye, 7.5 credits**

Ögats optik, 7.5 hp

This course syllabus is valid from spring 2009.

Please note that the course syllabus is available in the following versions:

Spring2009 , Spring2012

Course code	1OP017
Course name	Optics of the human eye
Credits	7.5 credits
Form of Education	Higher Education, study regulation 2007
Main field of study	Optometry
Level	G2 - First cycle 2
Grading scale	Fail (U), pass (G) or pass with distinction (VG)
Department	Department of Clinical Neuroscience
Decided by	Programnämnden för Optikerprogrammet
Decision date	2008-10-23
Course syllabus valid from	Spring 2009

## **Specific entry requirements**

Standardised admission requirements E.1.

## **Objectives**

On completion of the course, the student should be able to: - account for, choose and use appropriate eye models for various calculations of the eye as an optical system - make fast and simple calculations or estimates of units relevant to the correction of various types of refractive errors - in a simple way estimate and calculate paraxial optical side effects of glasses and contact lens correction - assess the optical effect of the lacrimal lens in the alignment of stable contact lenses - describe and carry out mathematical calculations necessary in super-refraction and statistical treatment of astigmatism - account for and rank the different optical limitations of the eye - through calculations estimate uncorrected visual acuity in various refractive errors and pupil sizes - interpret and evaluate measurement results from instruments measuring wavefront aberration of the eye - explain and interpret information about the concepts of PSF MTF, visual acuity and contrast sensitivity in the eye - explain and use relations between image quality and vision quality in the eye

## **Content**

The course is divided in two parts: 1) Optics of the eye - 6 higher education credits Paraxial

reproduction in the eye: Repetition of basic geometric optics. Eye models, refractive errors and the correction principle, top point distance, main point refraction, glass refraction and focal point refraction. Vergence calculations and vergence reasoning. Accommodation and external accommodation results. Optical side effects of glass and contact lens correction, anisometropia. The contact lens as a thick lens, the lacrimal lens effect, total and make-up astigmatism, respectively, astigmatic decomposition and super-refraction. Image quality and visual quality in the eye: Monochromatic and chromatic aberrations in the eye, wavefront aberration, Zernike polynomials, aberrometers, diffraction and transmission. PSF and MTF, visual acuity and contrast sensitivity, focal depths. 2) Lab experiments - 1.5 higher education credits Practical and theoretical laboratory assignments and computer simulations in imaging and visual quality.

## **Optics of the eye, 6.0 hp**

Grading scale: VU

Paraxial reproduction in the eye: Repetition of basic geometric optics. Eye models, refractive errors and the correction principle, top point distance, main point refraction, glass refraction and focal point refraction. Vergence calculations and vergence reasoning. Accommodation and external accommodation results. Optical side effects of glass and contact lens correction, anisometropia. The contact lens as a thick lens, the lacrimal lens effect, total and make-up astigmatism, respectively, astigmatic decomposition and super-refraction.

Image quality and visual quality in the eye:

Monochromatic and chromatic aberrations in the eye, wavefront aberration, Zernike polynomials, aberrometers, diffraction and transmission. PSF and MTF, visual acuity and contrast sensitivity, focal depths.

## **Lab experiments, 1.5 hp**

Grading scale: VU

Practical and theoretical laboratory assignments and computer simulations in imaging and visual quality.

## **Teaching methods**

The teaching is given in the form of lectures interleaved with calculation exercises and assisted problem solving where the theoretical knowledge is illustrated and practiced individually through calculation examples. The course also comprises laboratory sessions that aim at an increased understanding of the optics through simulations and practical assignments.

## **Examination**

The course is examined through written examination (6 credits, grading scale Fail/Pass/Pass with distinction) and approved laboratory sessions (1.5 credits, grading scale Fail/Pass). A Pass grade in the examination, and in the laboratory sessions, award a Pass grade in the whole course. The grade Pass with distinction is given to a whole course when the examination is graded with a Pass with distinction and the laboratory sessions with a Pass grade. Criteria for evaluating the parts of the course are established in separate documents When a student fails an examination, there will be an opportunity for a new examination. All in all, 6 opportunities for a new examination are provided for all parts

## **Other directives**

Course evaluation will be carried out in accordance with the guidelines established by the Board of Education.

# Literature and other teaching aids

*Freeman, Michael Harold*

## **Optics**

*Hull, C. C.; Charman, W. N.*

11. ed. : Oxford : Butterworth-Heinemann, 2003 - 563 s.

ISBN:0-7506-4248-3 LIBRIS-ID:8917891

[Library search](#)

*Rabbetts, R. B.*

## **Clinical Visual Optics**

4:e upplaga : Oxford: Butterworths - 488s. : 2007

ISBN:0-7506-8874-2

[Library search](#)

*Atchison, David A.*

## **Optics of the human eye**

*Smith, George*

Oxford : Butterworth-Heinemann, 2000, rei - xii, 269 p.

ISBN:0-7506-3775-7 LIBRIS-ID:10648168

[Library search](#)