Technology
Arts Sciences
TH Köln

Course
WIB - wave optics, interference, diffraction

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General information

Long name	wave optics, interference, diffraction
Approving CModule	WIB_BaET
Responsible	Prof. Dr. Michael Gartz Professor Fakultät IME
Level	Bachelor
Semester in the year	summer semester
Duration	Semester
Hours in self-study	78
ECTS	5
Professors	Prof. Dr. Michael Gartz Professor Fakultät IME
Requirements	complex number Mathematics 1 and 2 Physics, generally wave theory
Language	German
Separate final exam	Yes

Final exam

Details

Written examination with differentiated types of exercises of taxonomy ratings understanding, appliance, analyzing and synthesizing.
That means, within the excersises the terms coherence, interference, diffraction and polarisation have to be understood and can be exerted.The optical terms like harmonic wave, plane wave and spherical wave as well as the model of the electric magnetic wave have to be taken for the solution of an analysed optical question and have to be understood and can be exerted.

Understood and remebered formula and optical prinziple have to be combined for the solving of new types of excercises. Formulas have to be converted.

Minimum standard

50 % of the exercises with different taxonomy ratings correctly processed

Exam Type

Written examination with differentiated types of exercises of taxonomy ratings understanding, appliance, analyzing and synthesizing.
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Lecture / Exercises

Learning goals

Knowledge

optical settings align
Light in the description of wave optics
delimitation of the wave optics to the geometrical optics
Wave equation
mathematical definition of a wave
electric field strength
magnetic field strength
mathematival description of waves
harmonic wave
definition of intensity

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interference of waves
superposition principle = linear system
Two beam interference:
mathematical description
Michelson interferometer
Young's Double slit experiment
Mach-Zehnder interferometer
interference at thin layers

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coherence
definition of the coherence
temporal coherence / spectral distribution
spatial coherence / geometrical dilatation

Diffraction
elementary waves
Huygen's principle
Fraunhofer diffraction

diffraction at a slit
diffraction at a circular aperture
diffraction at a grating
diffracton at a zone plate
resolution power of optical instruments
Rayleigh criterion
Fraunhofer diffraction as Fourier transformation
transmission function of a slit
Fresnel diffraction
diffraction regime
Fresnel diffraction images
Fresnel zones
Fresnel zone plate
diffraction at a slit
Babinetsches principle

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polarisation
generation of polarised light
Brewster angle
dichroism
birefringence
reflection
scattering
linear, circular and elliptical polarisation
presentation of polarisation states as superposition of two linear polarised waves
mathematical description of polarisation
Jones vectors, Jones matrices
polarisation of active optical components

Skills

calcualtion of
field strength and intensity of two beam interference
coherence length
coherence time
spectral width of light source
contrast
path difference and phase difference

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defining of
the wave function and
the complex wave function

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generation
of a harmonic grating,
of polarised light

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determination of
states of polarisation
of chromatic lenght aberration of a zone plate

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distinguish / denominate
the interference phenomenon in case of polarised light
of astigmatism of a zone plate

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Exercises (whole course)	1
Exercises (shared course)	0
Tutorial (voluntary)	0

Separate exam

none

Practical training

Learning goals

Skills

align of optical settings

make record series of measurements and document them

generate diagrams

checking results for plausibility

recognize and understand correlations

make error analysis

realize basical optical set-ups, assemble, align, make a functional check

investigate natural scientific and technical principles by optical set-ups
project record series of measurements,
estimate error effects,
check the suitability of the set-up

make the evaluation of self generated record series of measurements
present measurement values graphically
calculate implicit values in correct mathematical manner from measurement values
recognize logical errors and name them
simulate measurement values with given formulas

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compose a traceable report
describe the conceptual formulation
state the method of resolution
represent the results in a clear manner
discuss the results in a technical, academic manner

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work on complex technical tasks by teamwork
organize in subtasks
present the results and make a critical discussion

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Practical training	1
Tutorial (voluntary)	0

Separate exam

none