Technology
Arts Sciences
TH Köln

Course Manual PBO

Project-based optics

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General information

Long name	Project-based optics
Approving CModule	PBO_BaET
Responsible	Prof. Dr. Michael Gartz Professor Fakultät IME
Valid from	summer semester 2023
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	Geometric optics Optical metrology wave optics Mathematics 1/2 Physics 1/2 elementary geometry
Language	German
Separate final exam	Yes

Literature

- Pedrotti, Pedrotti, Bausch, Schmidt: Optik für Ingenieure. Grundlagen (Springer)
- Hecht: Optik (Oldenbourg)
- Bergmann, Schaefer, Bd.3, Optik, de Gruyter
- Daniel Malacara, Optical Shop Testing, John Wiley and Sons
- Max Born und Emil Wolf, Principles of Optics, Cambridge University Press

Final exam

Details	Oral examination in which the taxonomy levels of understanding, applying, analysing, synthesising and evaluating are tested by students presenting and explaining their projects carried out during the semester and showing that they can understand and apply the technical terms, theories and procedures developed in the lecture, have analysed the requirements of their project task and have synthesised a solution to their project task and can evaluate it in the examination interview.
Minimum standard	50 % of the questions and tasks out of all parts of the examination correctly answered
Exam Type	EN mündliche Prüfung, strukturierte Befragung

− Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	Matrix Sensors CCD sensors superstructure mode of action sensitivity noise sources CMOS sensors superstructure mode of action sensitivity noise sources Image error corrections dark current correction flat field correction interfaces Analog / BAS Firewire 1394 USB Ethernet / GigE
Knowledge	Holographic interferometry double exposure holography basics superstructure evaluation applications time-average holography basics superstructure evaluation applications
Knowledge	laser light sectioning basics superstructure evaluation applications
Knowledge	Chromatic longitudinal aberrations basics superstructure evaluation applications

Special requirements

none

Accompanying material	Presentation slides for the lecture as pdf-files
Separate exam	No

Knowledge	Chapters of students' choice Laser Material Processing basics cold ablation thermal processing laser types applications Optical Shop Testing Twyman Green Interferometer Fizeau Interfermometer Laser Doppler Anemometry Interferometric speed measurement heterodyne principle applications ... (Students' suggestions)
Skills	calculate the dynamics of a CCD sensor of deformations in holographic interferometry of oscillation amplitudes in holographic interferometry the working range of the chromatic longitudinal aberration sensor the resolution of the light section sensor
Skills	define the resolution of matrix sensors the working range depending on a measuring task
Skills	determine of the wavefront aberrations of the sensitivity of a CDD sensor
Skills	assess of the measuring signal of a light section sensor of the usability of a matrix sensor for a specific measurement task

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Lecture	2
Tutorial (voluntary)	0

− Lecture / Exercises

Learning goals

Goal type	Description
Skills	Adjusting optical superstructures
Skills	Recording and documenting of measurement series
Skills	Create diagrams
Skills	Ergebnisse auf Plausibilität überprüfen
Skills	Recognizing and understanding of interrelationships
Skills	error calculation
Skills	analyse an optical measuring task Independently recognized measuring task can be analyzed Analyzing a given measuring task
Skills	design a solution approach for the analyzed optical measuring task Consideration of laboratory resources Consideration of the available time quota
Skills	Presentation of a project outline Describe the task outline the approach Present results in a clearly structured way Discuss results in technical and scientific manner
Skills	Milestone presentation to check the progress of the project Describe the task outline the approach Present results in a clearly structured way Discuss results in technical and scientific manner

Special requirements

none

Accompanying material	oral discussions with project supervisor with individual given references
Separate exam	No

Skills	Final presentation with presentation of the realized solution approach Describe the task outline the approach Present results in a clearly structured way Discuss results in technical and scientific manner
Skills	realize basic optical structures yourself build adjust Carry out function test
Skills	investigate scientific/technical principles with an optical structure Plan measurement series Estimate error influences Check the suitability of the superstructure
Skills	Evaluate self-acquired measurement series Graphic display of measured values Calculate implicit quantities from measured values math. correctly discover and name logical errors Simulate measured values using predefined formulas
Skills	Work on complex technical tasks in a team Organize into subtasks Discuss measurement results complement each other meaningfully

Expenditure classroom teaching

Type	Attendance (h/Wk.)
Project	2
Tutorial (voluntary)	0