Technology
Arts Sciences
TH Köln

Course Manual SRF

Radiation, radiometry, photometry

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General information

Long name	Radiation, radiometry, photometry
Approving CModule	SRF_BaET, SRF_BaOPT
Responsible	Prof. Dr. Michael Gartz Professor Fakultät IME
Valid from	summer semester 2022
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	differential calculus, integral calculus, trigonometry, 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
- Schröder, Technische Optik, Vogel Verlag
- Naumann, Schröder, Bauelemente der Optik, Hanser Verlag

Final exam

Details	Written examination with differentiated types of exercises of taxonomy ratings like understanding, appliance, analyzing and synthesizing. That means, within the exercises the terms like the basic optical principles of radiometry and photometry and the dihedral angle have to be understood and can be exerted. The optical correlations like radiation transfer law have to be understood and to be exerted for analyzed optical questions. Understood and remembered formula and optical principles have to be combined for the solving of new types of exercises. Formulas have to be converted.
Minimum standard	50 % of the exercises with different taxonomy ratings correctly processed
Exam Type	EN Klausur

− Lecture / Exercises

Learning goals

Goal type	Description
Knowledge	basic optical principles of radiometry and photometry spectrum of electromagnetic radiation colour colour temperature radiometric basic optical principles: differential solid angle radiant energy, power, output power per unit solid angle power output per unit area, power output per unit solid angle and unit emitting area, power input per unit area, energy per unit area photometric basic optical principles: luminance, luminous flux, luminosity, photometric brightness, illuminance, illumination Lambertian radiator radiation transfer law material classification figures to describe the interaction radiation with material spectral reflectance spectral transmittance spectral absorptance spectral emissivity thermal equilibrium stationariness
Knowledge	radiation laws of the Black-body radiation: Planck's law Rayleigh-Jeans law ultraviolet catastrophe Wien's law of radiation Wien's displacement law Stefan-Boltzmann law Kirschhoffsche laws
Knowledge	Scattering Raylegh scattering Mie scattering
Knowledge	radiation detector: photodiode spectrometer bolometer spezial detectors

Special requirements

none

Accompanying material	Presentation slides for the lecture as pdf-files, exercise task as downloadable files
Separate exam	No

Knowledge	properties of specialized elements and optical systems: radiationen sources black-body radiator grey radiator luminescence radiator specialized radiation sources: synchrotron, plasma source etc. selective radiators pyrometric optical set-up, functionality correction of environmental temperature light sources: halogen lamp electric discharge lamp LED
Skills	calculation of conversion of the spectral energy density to spectral radiance conversion of the frequency specific spectral radiance to wave length specific spectral radiance spectral radiant exitance from spectral radiance conversion between radiometric quantity and photometricquantity radiant efficiency wave length from band gap in case of led's
Skills	to distinguish specified time of thermal radiators specified time of luminescence radiators
Skills	to evaluate and to assess thermal radiators luminescence radiators discharge radiation sources

Expenditure classroom teaching

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

− Practical training

Learning goals

Goal type	Description
Skills	align of optical settings
Skills	make record series of measurements and document them
Skills	generate diagrams
Skills	checking results for plausibility
Skills	recognize and understand correlations
Skills	make mathematical error analysis
Skills	realize basical optical set-ups, assemble, align, make a functional check
Skills	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
Skills	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
Skills	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

Special requirements

none

Accompanying material	written instructions to each experiment as pdf-files
Separate exam	No

Skills	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