Technology
Arts Sciences
TH Köln

Course
SRF - Radiation, radiometry, photometry

Version: 1 | Last Change: 06.10.2019 13:46 | Draft: 0 | Status: vom verantwortlichen Dozent freigegeben

General information

Long name	Radiation, radiometry, photometry
Approving CModule	SRF_BaET, SRF_BaOPT
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	differential calculus, integral calculus, trigonometry, elementary geometry
Language	German
Separate final exam	Yes

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

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.

Lecture / Exercises

Learning goals

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

---

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

Scattering
Raylegh scattering
Mie scattering

---

radiation detector:
photodiode
spectrometer
bolometer
spezial detectors

---

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

---

to distinguish
specified time of thermal radiators
specified time of luminescence radiators

---

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

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 mathematical 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

---

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

---

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