

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

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^ 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

Scattering

Rayleigh scattering

Mie scattering

radiation detector:

photodiode

spectrometer

bolometer

spezial detectors

properties of specialized elements and optical systems:

radiation 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 photometric quantity

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