After the completion of the module the student will
- understand the theoretical basis of radiation models to be used in solar engineering processes.
- understand the principles and the modelling approaches of combined heat and mass transfer in solar processes.
- understand the effect of radiation in a solar process.
- understand the radiative heat transfer methods of resolution to be used in solar applications.
- understand the various assumptions and computing efficiency of radiation models.
- understand the models’ limitations to practical uses.
- acquire the knowledge of the main radiative properties of materials used in solar processes.
- be aware of the important development in radiation measurement.
- acquire knowledge of the optical measurement issues.
- have a critical understanding of the effect of radiation on fluid flows.
- have a critical understanding of radiation modelling in solar processes.
- have a critical understanding of the methodology that should be used in a practical situation where radiative heat transfer is to be solved, and coupled with other transfer modes.
- be able to compare and evaluate radiation simulation results from different models.
- have a critical understanding of optical properties and their influences on radiation heat transfer.
- will have a critical understanding of optical measurements.

Module contents
1. Radiative heat transfer
   - Fundamentals of Thermal Radiation
   - Radiative Exchange between Surfaces
   - Radiative properties of opaque surfaces
   - View factors
   - Radiative exchange between grey and diffuse surfaces
   - Equation of Radiative Transfer in Participating Media
   - Equation of radiative transfer
   - Formal solutions
   - Boundary conditions
   - Radiative Properties of Participating Media
   - Radiative properties of molecular gases
   - Radiative properties of particulate media
   - Radiative Transfer through Participating Media
   - Collimated irradiation
   - The Two-Flux method
   - The method of Discrete Ordinates
   - The Monte Carlo method
   - The Rosseland approximation
   - The Diffusion approximation
   - High temperature measurements
   - Pyrometry
   - Infrared thermography
2. Combined heat and mass
   - Conduction
   - Fundamental Equations
   - Balance equations
   - Examples
   - Convection
   - Fundamental Equations
   - Forced Convection (resolution of the Couette flow with temperature)
   - Natural Convection (approximation of Boussinesq)
   - Adimensional equations
   - CFD softwares

Reader’s advisory

Links

Language of instruction
English
<table>
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<tr>
<th>Examination</th>
<th>Time of examination</th>
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| Final exam of module| Written exam: End of the Semester / end of May  
Written report: during the semester / February to May | Written exam (50%): 2 hours  
Written report (50%): extended laboratory report, 10-20 pages |

**Course type**

Seminar

**SWS**

**Frequency**

**Workload attendance**  
0 h