

Solar Energy Conversion Devices and Plants

Personnel:

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Language:

English

Time and location:

- Lecture, Monday, 14:15-16:00, PH H3 31
- Exercises and TP, Monday, 16:15-18:00, PH H3 31 or ME D0 2720

Exam:

Group project (one 3-page report), laboratory report (one report for 5 TPs), computational exercise 2 (out of 3 submissions), and written exam in exam period (closed books, only calculator and 10 A4 pages personal summary)

Mark: 34% exam, 22% group report, 22% individual laboratory report, 22% individual computational projects

Course:

- Material online: moodle.epfl.ch
- Syllabus:

	Lecture	Exercise
Week 1	Introduction: Solar energy characteristics, solar energy conversion	Exercise 1 – group project
Week 2	Energy states in matter, basics in thermal transport, exergy analysis in solar systems	Exercise 2
Week 3	No lecture	
Week 4	Technology: Solar thermal collectors	Exercise 3
Week 5	Basics in optics, concentrating technologies, solar thermal (high-temp)	Computational exercise 1 (ex4)
Week 6	Solar electricity - CSP	
Week 7	Basics in semiconductors, junctions	Exercise 5
Week 8	Solar electricity - PV	Computational exercise 2 (ex6)
Week 9	Basics in thermochemistry, solar fuels by thermochemical path	
Week 10	Basics in electrochemistry (low and high-temperature)	Computational exercise 3 (ex7)
Week 11	Electrochemistry lab 1	
Week 12	Electrochemistry lab 2	
Week 13	Solar fuels by photo-eletctrochemical, photocatalysis	
Week 14	Special topics: thermoelectrics thermophotovoltaics	Exercise 8

Content:

The **generalities and fundamentals** cover: Solar energy characteristics, radiation and electromagnetic wave propagation, multi-mode heat transfer, semiconductor physics, electrochemistry, thermochemistry, fluid flow and species transport.

Solar fuels: Photocatalytic, photoelectrochemical, and solar thermochemical approaches, conversion devices, and technologies.

Solar electricity: PV and concentrated solar power approaches, devices, and technologies.

Solar heat: Low-temperature solar collectors and high-temperature solar receiver, thermal energy storage.

Computational examples and projects: Monte Carlo techniques, finite differences and finite volumes

Experimental techniques with laboratory projects: High-flux solar irradiation measurements, electrochemical techniques