PES Preparatory Online Module (Basics in Mathematics, Physics, Chemistry) Voluntary module (not credited)		
Program	Photovoltaics Engineering Science (Master of Science)	
Lecturer	Prof. Dr. Norbert Bernhard	
Semester	Before study start (or parallel to 1 <sup>st</sup> study semester)	
Workload	120 hours, including 60 teaching hours	
Forms of tuition	Lecture	30 h
	Exercises	30 h
	Self study	60 h
Forms of Media	Online presentations (Webex)	
Awarded Credit	none	
Language	English	
Examination	none	

### Target skills:

The students shall refresh their basic knowledge in mathematics, physics and chemistry as needed for the Master program Photovoltaics Engineering Science. The emphasis is on the knowledge needed for the physically and technologically orientated subjects of the winter semester (Therefore this online course is offered during the summer semester).

### **Contents:**

### **Mathematics**

- Infinitesimal calculus (differentiation and integration)
- Exponential function and hyperbolic functions
- Taylor's expansion
- Fourier series and Fourier transformation
- Differential equations
- Complex numbers
- Basics of vector calculus

# Physics

- Mechanics (Newton's laws; energy, momentum and angular momentum conservation)
- Thermodynamics (Laws of thermodynamics, thermodynamic potentials, entropy, equipartition law, phase diagrams)
- Electrodynamics (Kirchhoff's laws, electric and magnetic field in vacuum and matter, dielectric displacement, Maxwell equations, electromagnetic radiation)
- Optics (reflection, refraction, refractive index, lenses, interference, coherence, lasers)
- Radiation laws (Planck's law, black body radiation, Wien's law, Sfefan-Boltzmann law)
- Basics of atomic and solid state physics

# Chemistry

- Atomic structure and periodic table of elements (PTE)
- Physical and chemical properties of elements in dependence on position in PTE
- Atomic and molecular orbitals
- Reaction kinetics and mass action law
- Thermodynamics of chemical reactions
- Carbon, silicon and other semiconductor compounds
- Basics of organic and polymer chemistry

# Literature:

• tbd

# **Prerequisites:**

- School knowledge (as required for university entrance) in mathematics, physics, chemistry
- Knowledge of the first semesters of a typical engineering Bachelor program