

**Course number: tba**  
**Sensors and Drives**  
**Study level: Bachelor /**  
**Undergraduate**

**Prof. Dr. Hartmut Gimpel**  
**Language of instruction: English**  
**ECTS Credits: 5**

### **Subject-specific competencies:**

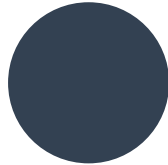
- The students have basic knowledge of sensors and data processing relevant to mechatronic engineering.
- They understand that measuring tasks are almost always solved in an interdisciplinary way (physics, electrical engineering, mechanical engineering, software).
- They have basic knowledge in digital acquisition and analysis of measurement data.
- They know the methods and concepts that can be used to solve data acquisition tasks.
- They have the ability to select the appropriate measurement methods and suitable sensors for a measurement task.
- They describe the task for a drive system and the interaction of drive and load.
- They distinguish between the different types of electrical machines and their fields of application.
- They derive quantitative statements from characteristic curve diagrams of electric motors.
- They draw qualitative and quantitative conclusions from descriptions and data sheets of electric motors.
- They design a drive system, consisting of frequency converter, motor and gearbox, for a given task.
- They know how to apply sensors and drives to acquire information and to solve challenges in future technologies like energy production or robot engineering.

### **Methodological competencies:**

- The students can plan the practical procedure for a measurement on an experimental setup and check the results for plausibility.
- They can document experimental results in a laboratory report according to specifications.
- They work out a specification in small groups and present them to an audience.
- They talk to others about sensors and electric drives.

### **Personal competencies:**

- The students can work together in a small group on one lab setup.
- They convince and be convinced in technical discussions.
- They use and understand the technical terms related to system dynamics in technical discussions and in technical reports.



## Teaching Content:

### Sensors and Data Acquisition

- basics of data acquisition
- calculation of measurement uncertainty according to GUM
- physics of operating principles used in sensors
- important sensors and measuring methods in mechatronics
- digital data acquisition and signal analysis methods

### Electric Drives

- Physical principles of torque generation
- Mechanical transmission elements
- DC motor
  - Design
  - Static and dynamic behaviour
  - Inverter and control
- BLDC motor
  - Commutation
  - Inverter
- Permanent Magnet Synchronous Motor
- Induction Motor
  - Working principle
  - Frequency inverter
- Stepper Motors
  - Types and working principles
  - Commutation and inverters

### Sensors and Drives Laboratory

- measurement of force, torque, pressure, length, temperature, level, rotation speed, vibration
- digital data acquisition with LabView or Arduino
- asynchronous motor
- BLDC motor