UNIVERSITÄT DUISBURG-ESSEN
Lehrstuhl Steuerung, Regelung
und Systemdynamik
Univ.-Prof. Dr.-Ing. Dirk Söffker

Sommersemester 2026

Course	**Measurement and Automation Technology (2V, 1Ü, 2P)**
Zielgruppe	**ISE (Bachelor)**
URL of the course	https://lehre.moodle.uni-due.de/course/view.php?id=12277
Lecturer	Univ.-Prof. Dr.-Ing. Dirk Söffker
Assistant	Mateusz Szkatula, M.Sc.
About course	In SoSe, the course will be realized in presence at the university. The course is based on the following material (downloadable via Moodle): - Lecture and exercise material (pdf) The basis of the course are textbooks defined in the material. The textbook collection is stated in a central document and is available in the university library. For each lecture unit a raw manuscript is published which can be downloaded in the Moodle course **from the beginning of the course (LU-wise)**. This serves to structure/individualize the personal notes. For preparation/postprocessing of the lecture it is strongly recommended ➢ **preparation of the previous material,** ➢ **attending the consultation hours,** ➢ **as well as reading the upcoming material in the given chapters in advance (in the specified textbook/textbook).**
Material	Moodle: Measurement and Automation Technology (https://lehre.moodle.uni-due.de/course/view.php?id=12277) The password can be requested via the e-mail address srs-pw@uni-due.de. The subject must contain the word **MAT**.
Day	Friday
Time	1:00 – 4:00 pm
Room	MB 144
First course	April 17
Last course	tbd, approximately June 19

Consulting hours	Wednesday, 08.00 – 09.30 am, MB 326
Literature	**PART I:** Automation, measurement, sensors etc. > see separate literature list **Part II:** System dynamics Lunze, J.: Regelungstechnik 1, Springer, 3. Auflage, 2001 (available in the library) **> L** Ogata, K.: Modern Control Engineering, 4th Edition, 2002. (available in the library) **> O**
Additional Reading	**Part II:** System dynamics Franklin, G.F.; Powell, J.D.; Emami-Naeini, A.: Feedback Control of Dynamic Systems, Prentice Hall 2002 (available in the library) Dorf, R.C.; Bishop, R.H.: Modern Control Systems, Pearson, 2005.
Content	**Part I: Automation, measurement, sensors etc.** **LU 1: Automation Technology** Significance of Measurement and Automation Technology in Modern Industry Objectives of Automation Technology Historical Context: From Mechanization to the Digital Revolution Fundamental Concepts and Strategic Goals of Automation Systems Automation Objectives and Automation Diverse Fields of Application for Modern Automation Technology Integrated Systems and the Rise of Networked Industrial Plants **LU 2: Measurement Technology** Understanding Measurement Technology and Analyzing Errors Introduction to the Importance of Measurement Science Distinguishing the Properties of Various Measured Quantities Classification and Physical Principles of Sensors and Actuators The Measurement Chain: Mapping Signals from Sensor to Actuator Performance Characteristics of Precision Measurement Devices Analyzing Systematic and Random Error Sources in Practice From Error to Uncertainty: The GUM Methodology Statistical Foundations and Rules of Error Propagation Practical Analysis Example and Troubleshooting in Harsh Environments Practical Analysis Example and Diagnostic Application Calibration Basics, Traceability, and Global Quality Standards Digital Challenges: Quantization, Sampling, and Signal Integrity **LU 3: Sensors** Performance: Characteristic Lines and Measurement Accuracy Temperature Measurement via PT100 Platinum Resistance Sensors Thermocouples: Utilizing the Seebeck Effect for Heat Detection Capacitive Sensors for Proximity and Level Measurement Optical Sensing: Photodiodes, Light Barriers, and Triangulation What Are Smart Sensors and Modern Digital Interfaces? Practical Sensor Systems and the Role of Sensor Fusion

	LU 4: Automation, IoT How Is the ISA-95 Automation Hierarchy Structured? What Is the Role of Data in Modern Plants? How Do Programmable Logic Controllers (PLC) Function? What Are the Standards for PLC Programming? Why and Where Are Classical Fieldbus Systems Used? How Does Industrial Ethernet Enhance Communication? What Is Industrial IoT? How Do Protocols Facilitate IoT Data Flow? Is Security Guaranteed in Automated Systems? What Is the Future of Industrial Automation? **Part II: Systemdynamics** 1 Terms, Definition, Idea of Feed Back, Technical Control (L 1 – 2.10, O1 + Material) 2 Dynamic Systems, Description of dynamical systems (L 3.1-3.2,4.1; O2.3(**), O3.4(*), O3.5(*), O11.4(*) [Eq. 11-25f,11-39f]) 3 Description of linear systems (L 4.1-4.3.3; O2.3(**),O3.4(*),O3.5(*),O11.4(*)[Eq. 11-25f,11-39f]) 4 Behavior of linear systems (L 5.1.1, L 5.1.2-5.2 + Material) 5 Time behavior of elements and loops (L 5.6 + Material)
Practical Exercise	Check separate notice
Exam	Written exam, 120 min, closed-book, **English OR German examination**, mandatory registration at the examination office