

DEPARTMENT OF ENERGY SCIENCE AND TECHNOLOGY
COURSE SYLLABUS

Course Details					
Code		Academic Year		Semester	
EBT319		2		4	
Title		T	A	L	ECTS
Measurement Technology		2	1	1	6
Language	German				
Level	Undergraduate		Graduate		Postgraduate
Department / Program	Face to face				
Forms of Teaching and Learning	On-campus study				
Course Type	Compulsory		Elective	x	
Objectives	<p>The course "Measurement Technology" imparts fundamental knowledge, methods, and tools for the acquisition, analysis, and evaluation of physical quantities. It thus forms a crucial foundation for advanced engineering and natural science studies. The course is aimed at students in the Bachelor's program in Energy Sciences and Technology. Accompanying exercises are offered alongside the lectures, in which students deepen their knowledge acquired in the lectures by independently working on problems, clarifying open questions, and practicing the confident application of typical solution methods. Learning outcomes are assessed by a mid-semester exam and a final exam at the end of the semester.</p>				
Content	<p>The course "Measurement Technology" teaches fundamental methods for acquiring non-electrical quantities and for evaluating and interpreting the measurement results. Upon successful completion of the course, students will demonstrate competence in the following areas:</p> <ul style="list-style-type: none"> - Fundamentals of Measurement Technology: Measurement uncertainty, sensor fundamentals, calibration, adjustment, and verification. - Measurement data transmission: Measured value output, measurement signal conversion. - Component Sensors: Position sensors, speed and rotational speed sensors, acceleration sensors, force/torque sensors, temperature sensors. - Selection of sensors and measurement methods. - Geometric Measurement Technology - Microtechnology: Structure-integrated sensors - Cyber-physical systems, Industry 4.0: Introduction to the topic 				
Prerequisites	No				
Coordinator	Dr.-Ing. Stefan Dilfer				
Lecturer(s)	Dr.-Ing. Stefan Dilfer				
Assistant(s)	No one				
Work Placement					
Recommended or Required Reading					
Books / Lecture Notes	Own lecture notes				

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Other Sources	<ul style="list-style-type: none"> • Messelektronik und Sensoren: Grundlagen der Messtechnik, Sensoren, analoge und digitale Signalverarbeitung, Herbert Bernstein, Springer Verlag, 2013 • Messtechnik: Vom SI-Einheitensystem über Bewertung von Messergebnissen zu Anwendungen der elektrischen Messtechnik, Reiner Parthier, Springer Verlag, 2019 • Taschenbuch der Messtechnik, Jörg Hoffmann, Hanser Verlag, 7. Auflage, 2015 • Elektrische Messtechnik, Thomas Mühl, Springer Verlag, 6. Auflage 2020 • Messtechnik und Sensoren: Grundlagen der Messtechnik, Sensoren, analoge und digitale Signalverarbeitung, Herbert Bernstein, 2013. • Grundlagen der elektrischen Messtechnik, Reinhold Drachsel, Verlag Technik Berlin, 1983. • Elektrische Messtechnik, Rainer Felderhoff, Carl Hanser Verlag, 7. Auflage 2002 • Messtechnik und Sensorik, in Mechatronik, H. Czichos, Springer Verlag
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Additional Course Material

Documents	
Assignments	
Exams	1 midterm exam @ 1 final exam

Course Composition

Mathematics und Basic Sciences	30	%
Engineering	70	%
Engineering Design		%
Social Sciences		%
Educational Sciences		%
Natural Sciences		%
Health Sciences		%
Expert Knowledge		%

Assessment

Activity	Count	Percentage (%)
Midterm Exam	1	40
Quiz		
Assignments		
Attendance		
Recitations		
Projects		
Final Exam	1	60
Total		100

ECTS Points and Work Load

Activity	Count	Duration	Work Load (Hours)
Lectures	14	2	28
Self-Study	10	6	60

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Assignments	4	8	32
Presentation / Seminar Preparation	-	-	-
Midterm Exam	1	3	3
Recitations	14	2	28
Laboratory	14	1	14
Projects	-	-	-
Final Exam	1	3	3
Total Work Load			168
ECTS Points (Total Work Load / Hours)			6

Learning Outcomes

1	Possess basic knowledge, methods and tools for recording, evaluating and assessing physical quantities.
2	They can develop metrological solutions for scientific problems using the methods they have learned.
3	They possess the flexibility to find new approaches and solutions.
4	They have the ability to critically analyze problems.

Weekly Content

1	Introduction to Metrology: Applications of metrology, development of metrology, SI system of units, inch system, volumetric mass
2	Metrological terminology, measurement methods, direct vs. indirect, representation of a measurement process
3	Measurement uncertainty, influencing factors, estimating quantities, measurement deviations
4	Calibration, adjustment, verification, traceability
5	Measurement transmission, sensor and measurement chain, static system behavior, dynamic system behavior
6	Measurement output: Measured value display, bar chart, structure diagram, graphical representation, process situation
7	Measurement signal conversion, analog and digital signals
8	Intermediate inspection
9	Component sensors: Length measurement technology (mechanical, digital), strain gauges, surface roughness
10	Position sensors: Resistance, electromagnetic, galvanomagnetic, optoelectronic, pneumatic sensors
11	Speed and rotational speed sensors, acceleration sensors, piezoelectric, capacitive sensors
12	Force/torque/pressure sensors: Piezoelectric, inductive, strain gauge force sensors
13	Temperature Sensors: Measuring principles, contact and non-contact temperature measurement, resistance temperature sensors (NTC, PTC), thermocouples, application: condition monitoring.
14	Selection of sensors and measuring methods: Monitoring of gearbox test benches, length measurement of CNC machine tools, length/angle measurement/rotary encoders with photoelectric scanning.
15	Geometric Metrology: Determination of geometric properties, microtechnology: MEMS (Micro Electro-Mechanical Systems), MOEMS (Micro Opto-Mechanical Systems), Application: measurement of kinematic and kinetic quantities, micro-temperature sensors.

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16	Final Examination						
Contribution of Learning Outcomes to Program Objectives (1-5)							
	P1	P2	P3	P4	P5	P6	P7
1					5		
2					5		
3					5		
4					5		
Contribution Level	1: Low 2: Low-intermediate 3: Intermediate 4: High 5: Very High						
Compiled by:	Dr.-Ing. Stefan Dilfer						
Date of Compilation:	30.03.2026						