

長岡工業高等専門学校		開講年度	令和04年度 (2022年度)		授業科目	電気電子計測
科目基礎情報						
科目番号	0045		科目区分	専門 / 必修		
授業形態	講義		単位の種別と単位数	履修単位: 2		
開設学科	電気電子システム工学科		対象学年	3		
開設期	通年		週時間数	2		
教科書/教材	Electric Electrical Measurement, written by Takeo Abe and Minoru Murayama					
担当教員	内富 直隆, 鳶 将哉					
到達目標						
(Course Code: 21230, English Title: Electric Measurements) (The weeks listed in the syllabus represent the frequency of classes) This course actively focuses on NIT (KOSEN), Nagaoka College's Educational Goal (C). The following table shows the achievement objectives of this course, evaluation weights, and the relationship between each achievement objective and the learning and educational achievement objectives set by KOSEN. ① To understand the operating principles and measurable ranges of basic indicating instruments: 25% (C2) ② To understand voltage and current measurement problems and learn methods to solve them: 25% (C2) ③ To understand the basic principles of electric power and electric energy measurements, as well as strategies to prevent measurement errors: 25% (C2) ④ To understand resistance and impedance measurement problems and learn methods to solve them: 25% (C2)						
ルーブリック						
	Ideal Level	Standard Level	Acceptable Level	Unacceptable Level		
Achievement 1	The student has a detailed understanding of the operating principles and measurable ranges of basic indicating instruments.	The student understands the operating principles and measurable ranges of basic indicating instruments.	The student vaguely understands the operating principles and measurable ranges of basic indicating instruments.	The student does not understand the operating principles and measurable ranges of basic indicating instruments.		
Achievement 2	The student has a detailed understanding of voltage and current measurement problems and has mastered methods to solve them.	The student understands voltage and current measurement problems and has learned methods to solve them.	The student vaguely understands voltage and current measurement problems and is familiar with methods to solve them.	The student does not understand voltage and current measurement problems and has not learned methods to solve them.		
Achievement 3	The student has a detailed understanding of the basic principles of electric power and electric energy measurements, as well as strategies to prevent measurement errors.	The student understands the basic principles of electric power and electric energy measurements, as well as strategies to prevent measurement errors.	The student vaguely understands the basic principles of electric power and electric energy measurements, as well as strategies to prevent measurement errors.	The student does not understand the basic principles of electric power and electric energy measurements or strategies to prevent measurement errors.		
Achievement 4	The student has a detailed understanding of resistance and impedance measurement problems and has mastered methods to solve them.	The student understands resistance and impedance measurement problems and has learned methods to solve them.	The student vaguely understands resistance and impedance measurement problems and has learned methods to solve them.	The student does not understand resistance or impedance measurement problems and has not learned methods to solve them.		
学科の到達目標項目との関係						
教育方法等						
概要	The extraordinary development of modern electrical and electronic engineering is built on a foundation of electrical and electronic measurement; there is barely any subfield of electrical and electronic engineering that is not related to measurement. This makes electrical and electronic measurement one of the most important basic subjects for students of electrical and electronic engineering. The objective of this course is not to simply list the many measuring instruments and methods currently available, but to understand the common principles of measuring instruments and the fundamentals of electrical and electronic measurement. ○Related Courses: Mathematics, Fundamentals of Electrical and Electronic Engineering (1st year), Basic Electric Circuits (2nd year), and The Mathematics of Electricity (2nd year).					
授業の進め方・方法	To measure students' level of understanding and improve academic skills, quizzes on class content will be conducted as necessary.					
注意点	At its core, indicating instruments cause a mechanical meter to swing with an electrical quantity that cannot be sensed by humans. Accordingly, the knowledge of general physics (especially force and motion of objects and the action of electricity and electric current) is essential for this course. In addition, students are encouraged to review the contents of the second-year course "Basic Electric Circuits" before taking this course. This course was originally planned as an in-person class; however, due to the COVID-19 pandemic, it will be conducted remotely when necessary.					
授業の属性・履修上の区分						
<input type="checkbox"/> アクティブラーニング		<input checked="" type="checkbox"/> ICT 利用		<input checked="" type="checkbox"/> 遠隔授業対応		<input type="checkbox"/> 実務経験のある教員による授業
授業計画						
		週	授業内容	週ごとの到達目標		
前期	1stQ	1週	Overview and Preparation for Electrical and Electronic Measurement	Learn the importance of electrical and electronic measurement.		
		2週	Position and Basic Concepts of Measurement	Understand the position and the basic concepts of measurement.		
		3週	Statistical Properties and Processing (1)	Gain a broad understanding of the mathematical errors and biases that form the basis of statistics.		
		4週	Statistical Properties and Processing (2)	Understand the mathematical and statistical population, mean, variance, etc., of measurements.		

後期		5週	Units and Standards (1)	Learn about the definition of units for representing physical quantities.
		6週	Units and Standards (2)	Learn the decibel notation required for electrical and electronic information.
		7週	Indicating Instruments (1)	Understand the structure and principles of movable coil-type indicators.
		8週	Midterm Examination of 1st	Exam length: 50 min
	2ndQ	9週	Indicating Instruments (2)	Understand the structure and operating principles of thermoelectric and electrostatic meters.
		10週	Measuring Direct Current with Indicating Instruments (1)	Understand the fundamentals of electrical measurement, including voltmeter multipliers and ammeter current dividers.
		11週	Measuring Direct Current with Indicating Instruments (2)	Understand the fundamentals of electrical measurement, including the null method and bridges.
		12週	Measuring Alternating Current with Indicating Instruments (1)	Learn about alternating current (AC) and AC power, as well as the phasors required for AC.
		13週	Measuring Alternating Current with Indicating Instruments (2)	Learn about the impedance and admittance of AC.
		14週	Electronic Devices and Functional Circuits for Measurement (1)	Learn the fundamentals of the semiconductors and electronic devices necessary for electronic measurement.
		15週	Electronic Devices and Functional Circuits for Measurement (2)	Learn about the functional circuits used in measurement.
		16週	Week 16: End of Semester Examination of 1st Week 17: Exam Review / Enrichment Class	Exam length: 50 min
	3rdQ	1週	Electronic Devices and Functional Circuits for Measurement (3)	Learn about functional circuits using operational amplifiers.
		2週	Digital Measurement (1)	Study the basic concepts of digital measurement.
		3週	Digital Measurement (2)	Study the basic concepts of digital measurement.
		4週	Waveform	Study the basics of the oscilloscope.
		5週	Frequency and Phase (1)	Most electric and electronic phenomena are related to waves. Learn the basics of the mathematics required to handle these phenomena.
		6週	Frequency and Phase (2)	Learn about frequency spectrum, power spectral density, etc.
		7週	Frequency and Phase (3)	Learn about phase and the methods for measuring it.
		8週	Midterm Examination of 2nd	Exam length: 50 min
	4thQ	9週	Noise (1)	Learn about noise that appears in electric measurements.
		10週	Noise (2)	Learn about the various types of noise.
		11週	Resonance	Understand that resonators fulfill an important role in AC circuit measurements and learn the frequency response of resonant circuits.
		12週	Transmission Lines and Impedance Matching (1)	Understand distributed constant circuits, which is an important concept in high-frequency circuits.
		13週	Transmission Lines and Impedance Matching (2)	Learn about transmission lines and impedance matching.
		14週	Magnetic Measurement	Learn the basics of magnetic measurement.
		15週	Comprehensive Review and Exhibit of Electric and Electronic Measurement	Summary and supplementary explanations of electric and electronic measurement.
		16週	Week 16: End of Semester Examination of 2nd Week 17: Exam Review / Enrichment Class	Exam length: 50 min

モデルコアカリキュラムの学習内容と到達目標

分類	分野	学習内容	学習内容の到達目標	到達レベル	授業週
専門的能力	分野別の専門工学	電気・電子系分野	計測	計測方法の分類(偏位法/零位法、直接測定/間接測定、アナログ計測/デジタル計測)を説明できる。	4
				精度と誤差を理解し、有効数字・誤差の伝搬を考慮した計測値の処理が行える。	4
				SI単位系における基本単位と組立単位について説明できる。	4
				計測標準とトレーサビリティの関係について説明できる。	4
				指示計器について、その動作原理を理解し、電圧・電流測定に使用する方法を説明できる。	4
				倍率器・分流器を用いた電圧・電流の測定範囲の拡大手法について説明できる。	4
				A/D変換を用いたデジタル計器の原理について説明できる。	4
				電圧降下法による抵抗測定の原理を説明できる。	4
				ブリッジ回路を用いたインピーダンスの測定原理を説明できる。	4
				有効電力、無効電力、力率の測定原理とその方法を説明できる。	4
				電力量の測定原理を説明できる。	4
				オシロスコープの動作原理を説明できる。	4

評価割合

	Midterm Examination of 1st	End of Semester Examination of 1st	Midterm Examination of 2nd	End of Semester Examination of 2nd	合計
総合評価割合	10	20	30	40	100
Basic Proficiency	0	0	0	0	0
Specialized Proficiency	10	20	30	40	100
Cross Area Proficiency	0	0	0	0	0