

Anan College		Year	2024	Course Title	Electrical Measurement
Course Information					
Course Code	1313F01		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	School Credit: 2	
Department	Course of Electrical Engineering		Student Grade	3rd	
Term	Year-round		Classes per Week	前期:2 後期:2	
Textbook and/or Teaching Materials	Electrical and electronic measurement (Morikita Publishing)				
Instructor	Matsumoto Takashi,Fujihara Takeshi				
Course Objectives					
1. Basic knowledge of measurements, measurement methods, errors, and unit systems can be explained and classified. 2. Able to understand the operating principle of the indicator, explain current / voltage measurement, and select an accurate indicator. 3. Able to explain the measurement principle of resistance and impedance. 4. Able to understand the measurement principle of electric power and electric energy, and explain the oscilloscope waveform measurement method.					
Rubric					
	Ideal achievement level (excellent)		Standard achievement level (good)		Minimum achievement level (possible)
Achievement 1	Able to explain and classify measurements, measurement methods, errors, and unit systems, and able to process measured values in consideration of errors.		Able to explain and classify measurements, measurement methods, errors, and unit systems.		Able to give a basic explanation of measurements methods, errors, and unit systems.
Achievement 2	Able to understand the operating principle of the indicator, explain current / voltage measurement, select an accurate indicator, and expand the measurement range according to the conditions.		Able to understand the operating principle of the indicator, explain current / voltage measurement, and select an accurate indicator.		Able to understand the operating principle of the indicator and explain current / voltage measurement.
Achievement 3	Able to explain the measurement principle of resistance and impedance, and select and measure the correct measurement principle.		Able to explain the measurement principle of resistance and impedance, and measure as directed measurement principle.Able to explain the measurement principle of resistance and impedance.		Able to explain the measurement principle of resistance and impedance.
Achievement 4	Able to explain the measurement principle of electric power and electric energy, and measure the phase difference from the Lissajous figure.		Able to understand the measurement principle of electric power and electric energy, and explain the phase difference by oscilloscope waveform observation.		Able to understand the measurement principle of electric power and electric energy, and explain the oscilloscope waveform observation method.
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	Understanding the basic theory of electrical measurement, indicator instruments, and methods of measuring various electrical quantities are the basic requirements for an electrical engineer. Through this lecture, the purpose is to acquire the basic theory and necessary knowledge and methods related to electrical and electronic measurement.				
Style	Classes will be centered on lectures, but we will also learn from each other in pairs and groups. Tasks will be given to confirm the degree of understanding.				
Notice	What you learned in basic electrical subjects such as electrical circuits and electromagnetism is applied to measuring instruments. I would like you to understand the basic theory of electrical systems and the measurement principle in relation to each other, not by rote memorization.				
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class	
				<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
1st Semester	1st Quarter	1st	Basics of measurement	Briefly explain the measurement of electricity.	
		2nd	Basics of measurement	Explain the classification of measurement methods, measurement errors, and accuracy.	
		3rd	Basics of measurement	The regression line can be obtained by the method of least squares.	
		4th	Basics of measurement	Measured values can be processed in consideration of error propagation.	
		5th	Basics of measurement	Measured values can be processed in consideration of significant figures.	

2nd Semester		6th	Unit system and standard	Explain the traceability of SI system of units and metric standards.
		7th	Standard of electricity amount	Explain the standard of electricity quantity and the standard.
		8th	Mid-term exam	
	2nd Quarter	9th	Classification and configuration of indicator	Can classify indicator instruments. Explain the components of the indicator.
		10th	Principle of indicator	Explain the operating principle and features of movable coil type instruments and movable iron piece type instruments. The average value and effective value of alternating current can be calculated.
		11th	Principle of indicator	Explain the operating principles and features of each of the current force meter type, rectifying type, thermoelectric type, and electrostatic type measuring instrument.
		12th	Summary / Exercise	
		13th	Expansion of measurement range	The measurement range can be expanded by using a shunt, a multiplier, an instrument transformer, and an instrument transformer.
		14th	Potentiometer / galvanometer	Explain the principle of the potentiometer Explain the internal resistance measurement of the galvanometer.
		15th	Summary / Exercise	
		16th	Final exam Return exam	
	3rd Quarter	1st	Measurement of resistance and impedance	Explain how to measure resistance from low resistance to high resistance.
		2nd	Measurement of resistance and impedance	Explain the error in the voltage-ammeter method.
		3rd	Measurement of resistance and impedance	Explain the measurement principle of ground resistance and insulation resistance.
		4th	Measurement of resistance and impedance	Explain resistance measurement using a DC bridge.
		5th	Measurement of resistance and impedance	Explain impedance measurement using an AC bridge.
		6th	Measurement of resistance and impedance	Explain inductance / capacitance measurement.
		7th	Measurement of resistance and impedance	Explain frequency measurement by utilizing inductance / capacitance measurement.
		8th	Mid-term exam	
	4th Quarter	9th	Measurement of electric power, power factor, and electric energy	Explain the error in power consumption measurement of DC circuit.
		10th	Measurement of electric power, power factor, and electric energy	Explain the measurement principle of a single-phase wattmeter.
		11th	Measurement of electric power, power factor, and electric energy	Explain the measurement of single-phase active power, reactive power, and power factor.
		12th	Measurement of electric power, power factor, and electric energy	Explain the measurement of active power, reactive power, and power factor of three-phase AC.
		13th	Measurement of electric power, power factor, and electric energy	Explain the measurement of electric energy and the integrated wattmeter.
		14th	Signal waveform measurement	Explain the principle of oscilloscope and waveform observation (amplitude, frequency, period).
		15th	Signal waveform measurement	Explain the Lissajous figure. Explain various sensors.
		16th	Final exam Return Exam	

#### Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	0	0	30	0	100
Basic Proficiency	0	0	0	0	10	0	10
Specialized Proficiency	70	0	0	0	20	0	90
Cross Area Proficiency	0	0	0	0	0	0	0