

Akashi College		Year	2022	Course Title	Advanced Instrumentation Engineering
Course Information					
Course Code	4017		Course Category	Specialized / Elective	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Mechanical and Electronic System Engineering		Student Grade	Adv. 1st	
Term	First Semester		Classes per Week	2	
Textbook and/or Teaching Materials					
Instructor	FUJIWARA Seiji				
Course Objectives					
The goal is to achieve a comprehensive understanding of each of the following items and to appropriately apply the knowledge learned. (1) Measurement data processing (units and standards, and statistical data processing) (2) Measurement systems analysis and characterization (system evaluation methods and digital signal processing) (3) Various basic measurement principles (basic principles and their applications)					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Understand and can apply measurement data processing (units and standards, and statistical data processing).		Understand measurement data processing (units and standards, and statistical data processing).		Do not understand measurement data processing (units and standards, and statistical data processing).
Achievement 2	Understand and can apply measurement systems analysis and characterization (system evaluation methods, and digital signal processing).		Understand measurement systems analysis and characterization (system evaluation methods, and digital signal processing).		Do not understand measurement systems analysis and characterization (system evaluation methods, and digital signal processing).
Achievement 3	Understand and can apply various basic measurement principles (basic principles and their applications).		Understand various basic measurement principles (basic principles and their applications).		Do not understand various basic measurement principles (basic principles and their applications).
Assigned Department Objectives					
Teaching Method					
Outline	Recent breakthroughs in technology demand more accurate measurements. In addition, there is an increasing need for computer-based measurement automation and online and in-process measurement in production systems. This lecture will 1) briefly review the basic items common to various applied measurements (what is measurement engineering, units and standards, measurement data processing, measurement system characteristics and system analysis, etc.); then 2) discuss in detail the various basic measurement principles (basic principles of signal conversion).				
Style	Classes will be held in a lecture style.				
Notice	This course's content will amount to 90 hours of study in total. These hours include the learning time guaranteed in classes and the standard self-study time required for pre-study / review, and completing assignment reports. Students who miss 1/3 or more of classes will not be eligible for a passing grade.				
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	Introduction What is metrology? Study the engineering meaning of measurement, instrumentation, weighing, etc. and the purpose of measurement.	Understand what metrology is and its basic concepts.	
		2nd	Measurement basics Study units and standards, and solidify knowledge of SI base units and dimensional analysis. Study the basic methods of measurement and measurement system planning and clarify the purpose of measurement.	Study units and standards and understand SI base units and dimensional analysis.	
		3rd	Measurement data error and accuracy Study measurement errors and measurement accuracy, identify the causes of errors, and study how to reduce errors and improve accuracy.	Understand measurement errors and accuracy, and how to reduce error.	
		4th	Measurement data statistical processing Study the statistical processing of measurement data and learn the correct data processing methods through examples.	Understand the statistical processing of measurement data.	
		5th	Measurement systems and system analysis Study the basic configuration and characteristic analysis of measurement systems, and learn basic characteristic analysis techniques.	Understand the basic configuration and characteristic analysis of measurement systems.	
		6th	Mechanical sensors (1) Study mechanical expansion principles (screws, gears, and lever).	Understand mechanical extension principles (screws, gears, and lever).	

		7th	Mechanical sensors (2) Study the application of elastic deformation to sensors and the measurement of vibration using the seismic system.	Understand the application of elastic deformation to sensors and the measurement of vibration using the seismic system.
		8th	Mechanical sensors (3) Study the gyro principle and its application.	Understand the gyro principle and its application.
	2nd Quarter	9th	Electric and electronic sensors (1) Study the application of impedance changes, in particular the principle and application of resistance line strain gauges that have extensive range of applications.	Understand the application of impedance changes, in particular the principle and application of resistance line strain gauges that have extensive range of applications.
		10th	Electric and electronic sensors (2) Study the application of impedance changes (changes in capacitance and electromagnetic induction).	Understand the application of impedance changes (changes in capacitance and electromagnetic induction).
		11th	Electric and electronic sensors (3) Study the application of piezoelectric and Seebeck effect to sensors.	Understand the application of piezoelectric and Seebeck effect to sensors.
		12th	Fluid type sensor Study fluid volume measurement using the fluid principle and the principle of an air micrometer.	Understand the fluid volume measurement using the fluid principle and the principle of an air micrometer.
		13th	Optical sensors Study the principles and applications of the optical interference and Moiré methods. Study measurement improved accuracy and its factors through the accuracy of optical sensors.	Study the principles and applications of the optical interference and Moiré methods. Understand measurement improved accuracy and its factors through the accuracy of optical sensors.
		14th	Other methods Study sensors using wave phenomena.	Understand sensors using wave phenomena.
		15th	Summary Study a measurement system's case study as a conclusion for the total 14 weeks.	Understand a measurement system's case study as a conclusion for the total 14 weeks.
		16th	Report assignment	

Evaluation Method and Weight (%)

	Understanding and efforts the lecture	Report	Total
Subtotal	60	40	100
Basic Proficiency	0	0	0
Specialized Proficiency	60	40	100
Cross Area Proficiency	0	0	0