Tsuyama College	Year	2023	Course Title	System Control Engineering

Course Information

Course Code	0031	Course Category	Specialized / Elective
Class Format	Lecture	Credits	Academic Credit: 2
Department	Advanced Mechanical and Control System Engineering Course	Student Grade	Adv. 2nd
Term	Second Semester	Classes per Week	2
Textbook and/or Teaching Materials	Distribute text materials.		
Instructor	YAGI Hideyuki		

Course Objectives

Learning purposes : Explain the state-space model expressed in the time domain for the system expressed by the transfer function, and understand the concept of controllability and observability of the system.

Course Objectives :
1. A state-space representation can be constructed from a real system.
2. the equation of a state-space representation can be solved.
3. Understand controllable and observable, and be able to judge controllable and observable system.
4. The poles of the system can be specified by state feedback.

Rubric

	Excellent	Good	Acceptable	Not acceptable
Achievement 1	The theory of state-space models can be applied to complex problems.	Understand the theory of state-space models.	Understand the basic theory of state-space models.	The student will not try to understand the basic theory of state-space models.
Achievement 2	Evolved theories can be applied to the coordinate transformation of state-space equation.	Understand the coordinate transformation of state-space equation.	Understand the basic coordinate transformations of state-space equation.	The student will not try to understand the coordinate transformation of state-space equations.
Achievement 3	Evolved theories can be applied to the concepts of controllability and observability of systems.	Understand the theory of system controllability and observability concepts.	Understand the basic theory of system controllability and observability concepts.	The student will not try to understand the theory of system controllability and observability concepts.
Achievement 4	Control system design theory by state feedback can be applied to applied problems.	Understand control system design by state feedback.	Understand basic control system design by state feedback.	The student will not try to understand the control system design by state feedback.

Assigned Department Objectives

Teaching Method

Outline	General or Specialized : Specialized Field of learning : Foundational academic disciplines : Engineering / Electrical and electronic engineering / Control and system engineering Relationship with Educational Objectives : This class is equivalent to "(3) Acquire deep foundation knowledge of the major subject area". Course outline : In this lecture, the modeled system will be analyzed by modern control theory. We will discuss the stability theory of these systems, controllability / observability, structural analysis, etc. in a unified manner based on the equations of state.
Style	Course method : Lectures will be given with examples of control models for "inverted two-wheeled vehicle robots", from modeling complex systems to control design methods. In addition, we will impose reporting tasks to deepen understanding. Grade evaluation method : Exams (70%) + Mini tests (30%). Retaking exams may be conducted after the regular exams, but the score of the regular exams will be re-evaluated up to 60 points. Confirmation exams conducted during class and learning outcomes outside class hours (exercises for assignments, reports, etc.) are evaluated equally (30%). However, learning outcomes that have passed the submission deadline will be evaluated up to 20%.

Notice	Precautions on the enrollment : This is a class that requires study outside of class hours. A total of 45 hours of study is required per credit, including both class time and study outside class time. Follow the instructions of the instructor regarding study outside of class hours. Course advice : As a preparatory study to be done in advance, it is desirable to understand what was learned in the control engineering. Foundational subjects : Control Engineering (4th or 5th year), Advanced Controls Engineering (5th) Related subjects : Linear Algebra (Adv. 1st) Attendance advice : In this lecture, we will make full use of our knowledge of linear algebra. Matrix operations can be calculated efficiently using a computer, but basic calculations must be confirmed by handwork. It is also important to complete the given task without delay. Those who attend the class at the beginning of the class, do not receive a reply at that time, and then enter the room will be late. If you are late three times, you will be absent once.

Characteristics of Class / Division in Learning

☐ Active Learning	☐ Aided by ICT	☑ Applicable to Remote Class	☐ Instructor Professionally Experienced

Elective subjects

Course Plan

			Theme	Goals
2nd Semester	3rd Quarter	1st	Guidance	
		2nd	Dynamical system and state-space equation	
		3rd	System model and linearization(1)	
		4th	System model and linearization(2)	
		5th	System model and linearization(3)	
		6th	System model and linearization(4)	
		7th	Solution of state-space equation	
		8th	Controllability, observability and judgment method	
	4th Quarter	9th	Coordinate transformation of state-space system(1)	
		10th	Coordinate transformation of state-space system(2)	
		11th	Structural analysis of linear system	
		12th	System stability and its distinction	
		13th	Poles specification by state feedback	
		14th	Poles specification by output feedback	
		15th	(2nd semester final exam)	
		16th	Return and commentary of exam answers	

Evaluation Method and Weight (%)

	Examination	Presentation	Learning outcomes	Behavior	Portfolio	Other	Total
Subtotal	70	0	30	0	0	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	70	0	30	0	0	0	100
Cross Area Proficiency	0	0	0	0	0	0	0