Tsuyama College		Year	2021		Course Title	Robot Control

Course Information

Course Code	0167	Course Category	Specialized / Elective
Class Format	Lecture	Credits	Academic Credit: 2
Department	Department of Integrated Science and Technology Advanced Science Program	Student Grade	5th
Term	First Semester	Classes per Week	2
Textbook and/or Teaching Materials	Textbooks : "Basic Theory of Control -Classical Control and Modern Control-"(Corona publishing)		
Instructor	INOUE Hiroyuki		

Course Objectives

Learning purposes :
To understand the concept of state feedback control, which is the basic method of modern control theory, and acquire the ability to design control systems.

Course Objectives :
1. To express the control system using the state equation and the output equation.
2. To discriminate controllability and observability.
3. To discriminate stability or instability using stability criterion.
4. To explain the concept of state feedback control.

Rubric

	Excellent	Good	Acceptable	Not acceptable
Achievement 1	To express the control system using the state equation and the output equation based on a numerical expression.	To express the control system using the state equation and the output equation.	To understand the state equation and the output equation.	Not reached the left.
Achievement 2	To understand and to judge controllability and observability.	To discriminate controllability and observability.	To discriminate controllability or observability.	Not reached the left.
Achievement 3	To understand and to judge stability or instability using two stability criterions.	To discriminate stability or instability using two stability criterions.	To discriminate stability or instability using one stability criterion.	Not reached the left.
Achievement 4	To design state feedback control.	To explain the concept of state feedback control.	To understand the purpose of state feedback control.	Not reached the left.

Assigned Department Objectives

Teaching Method

Outline	General or Specialized : Specialized Field of learning : Energy / Measurement and Control Foundational academic disciplines : Engineering / Mechanical Engineering / Mechanical Mechanics / Control Relationship with Educational Objectives : This class is equivalent to "(3) Acquire deep foundation knowledge of the major subject area" Relationship with JABEE programs : The main goals of learning / education in this class are "(A) , A-2 Course outline : In the robot control, to learn about the stabilization of control systems and the improvement of response based on modern control theory. To learn controllability and observability based on the state equation.To learn the discrimination law of stability or instability.
Style	Course method : Modern control theory is based on matrix operations, linear algebra is reviewed first, and then control methods based on the state equation of dynamic systems are explained in detail. Grade evaluation method : Exams (70%) + Mini tests and portfolio (30%). A grade of less than 60 points may be required to retake the exam, and the average of the regular exam and the re-exam will be re-calculated for the exam, and if the grade exceeds 60 points, the student will receive a score of 60 points.
Notice	Precautions on the enrollment : Students must take this class (no more than one-third of the required number of class hours missed) and earn the credit in order to complete the 5th year course.This is a "class that requires study outside of class hours". Classes are offered for 15 hours per credit, but 30 credit hours are required in addition to this. Follow the instructions of your instructor for these studies. Course advice : Modern control theory uses matrix calculation, so it should be reviewed thoroughly. Foundational subjects : Control Engineering (4th year) Related subjects : Sensor Engineering (5th year) Attendance advice : If you are late for the start time, you will be treated as absent after 25 minutes.

Characteristics of Class / Division in Learning

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

E l e c t i v e   m u s t   c o m p l e t e   s u b j e c t s

Course Plan

			Theme	Goals
1st Semester	1st Quarter	1st	Guidance, Modern control theory	Express control system using block diagram
		2nd	State equation and output equation	Express control system using state equation and output equation
		3rd	Transfer function	Express transfer function from transfer function
		4th	Stability and stability criterion	Discriminate stability and instability of the control system using the stability criterion.
		5th	Controllability and observability	Discriminate controllability and observability of the control system
		6th	Controllable canonical form	Transform the system into a controllable canonical form.
		7th	Observable canonical form	Transform the system into a observable canonical form.
		8th	1st semester mid-term exam	
	2nd Quarter	9th	Return and commentary of exam answers	
		10th	Series compensator	Design series compensator
		11th	Observer	Design observer
		12th	Iiternal model principle	Explain the concept and components of feedback control.
		13th	Proportional control	Explain steady-state characteristic of control system.
		14th	Integral control	Design PI control system.
		15th	1st semester final exam	
		16th	Return and commentary of exam	

Evaluation Method and Weight (%)

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