

Course Code	TKEE163233
Course Name	Adaptive System
Course Instructors	Adhi Soesanto
Course Type	Required
Course Classification	Engineering Topics
Credit / Contact Hour per Week	2 / 100 minutes per Week
Course Description	The objective of this course is to describe about fundamentals of adaptive system, especially for digital signal filtering and control engineering also some real application in engineering field will be taught. Topics are include concept of adaptive, implementation from adaptive algorithms, performance measures from an adaptive system. For digital filtering will focus on LMS and RLS algorithm. For digital control will focus on MTI Rule and Lyapunov based on MRAC algorithm.
Prerequisites Courses	Signal and System; Linear Algebra; Control Engineering
Covered Student Outcome	Development of Engineering Solution (b) Engineering Design (c)
Learning Outcome	<ol style="list-style-type: none"> 1. Students are able to model to parametric systems, either in time or frequency domain. 2. Students are able to understand optimality concept, cost function, error measures, Lyapunov Stability and Lagrange Multiplier. 3. Students are able to design system based on adaptive concepts and adaptive algorithms such as LMS and RLS. 4. Students are able to analyze an adaptive system performance. 5. Students are able to design control system based on MTI Rule Algorithm and Lyapunov based on MRAC.
Topic	<ol style="list-style-type: none"> 1. Adaptation as a approximation The objective of this topic is to introduce a concept of adaptation is an approximation in a real system. Will focuse to digital filtering as an approximation from a function. 2. Wiener Filter Introduce about Wiener Filter and some applications, for example to signal smoothing, noise cancelling and so on. 3. Iterative algorithms The objective of this topic is to introduce iterative algorithms that often used to solve engineering problems. 4. Adaptive algorithm There are two algorithms that will be introduced, Least mean Square (LMS) and Least Square (LS) 5. LMS Based on Frequency Domain Adative LMS method will be taught, include with examples in real world. 6. RLS RLS is an advance development of LS. 7. Adaptive filtering implementation MATLAB will be used to implement adaptive filter that have been studied. A case study will be held to motivate students. 8. Adaptive control engineering basics Adaptive control engineering algorithm will be taught after Online parameter estimation and dynamic system modeling Parameter estimation can be solved by gradient nad LMS methods, input and ouput model, fundamentals of estimation through observer. 9. Model Reference Adapive Control (MRAC) MRAC using MIT Rule method will be introduced, including with some examples. 10. MRAC and parameters implementation using MATLAB

Direct Assessment	Direct Assessment Plan		Measured Learning Outcome	
	Engineering Design Assignment – Creating Proof of Concept		LO2, LO4	
	Engineering Design Assignment – Presenting the solution		LO3	
	Mid Exam		LO1, LO4	
	Final Exam		LO1, LO2	
Indirect Assessment	Questionnaire (EDOM)			
References	<p>[1] Adaptive Filter Theory (5th Edition), Simon Haykin, Pearson, 2013</p> <p>[2] Adaptive Signal Processing, Bernie Widrow and Stearns, Prentice Hall, 1980</p> <p>[3] Fundamentals of Adaptive Filtering, Ali Sayed, Wiley, 2003</p> <p>[4] Robust Adaptive Control, Petros Ioannou, Wiley, 2002</p>			