



**INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)**  
**FAKULTAS TEKNOLOGI ELEKTRO DAN INFORMATIKA CERDAS**  
**DEPARTEMEN TEKNIK ELEKTRO**  
**Program Studi Sarjana (S1) Teknik Elektro**

**INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS)**  
**FACULTY OF INTELLIGENT ELECTRICAL & INFORMATICS TECHNOLOGY**  
**DEPARTMENT OF ELECTRICAL ENGINEERING**  
**Bachelor Degree Program in Electrical Engineering**

<b>1</b>	<b>Nama Mata Kuliah / Course Name</b> : Sistem Kontrol Cerdas / <i>Intelligent Control Systems</i>
<b>2</b>	<b>Kode Mata Kuliah / Course Code</b> : EE234737
<b>3</b>	<b>Kredit / Credits</b> : 2 SKS
<b>4</b>	<b>Semester / Semester</b> :

#### **Deskripsi Mata Kuliah / Course Description**

Sistem Kontrol Cerdas mempelajari metode perancangan sistem kendali menggunakan kontrol fuzzy dan jaringan syaraf tiruan, serta optimasi menggunakan algoritma genetika. Perancangan aturan dasar sistem fuzzy tipe Mamdani dan Sugeno menggunakan metode heuristik dibahas. Model fuzzy Takagi-Sugeno digunakan untuk merepresentasikan dinamika sistem nonlinier berdasarkan aturan bagi pengontrol dengan menggunakan konsep Parallel Distributed Compensation. Validasi desain sistem fuzzy diterapkan pada sistem nyata. Metode jaringan saraf juga dibahas dan digunakan untuk tujuan pengendalian sistem, sedangkan algoritma genetika digunakan untuk menyelesaikan masalah optimasi pada sistem kendali. / *Intelligent Control Systems studies the method of control systems design using fuzzy control and neural network, and optimization using genetic algorithm. Design of basic rules of fuzzy systems of the Mamdani and Sugeno types use heuristic method are discussed. The Takagi-Sugeno fuzzy model is used to represent the dynamics of a nonlinear system on the basis of rules for controllers using the concept of Parallel Distributed Compensation. Validation of fuzzy system design is applied to real systems. Neural network methods are also discussed and used for system control purposes, while genetic algorithms are used to solve optimization problems in the control system.*

#### **Capaian Pembelajaran Lulusan (CPL) Yang Dibebankan Mata Kuliah / Program Learning Outcomes Charged to The Course**

1. Menguasai konsep dan prinsip prosedur perancangan pada sistem tenaga listrik, sistem kendali, telekomunikasi multimedia, atau elektronika. / *Mastering the concepts and principles of design procedure in power systems, control systems, multimedia telecommunications, or electronics.*
2. Mampu menguraikan penyelesaian permasalahan teknik pada sistem tenaga listrik, sistem kendali, telekomunikasi multimedia, atau elektronika. / *Able to describe the completion of engineering problems in power systems, control systems, multimedia*

telecommunications, or electronics.

3. Mampu menunjukkan kinerja mandiri, berkualitas, dan terukur. / Able to demonstrate independent performance, quality, and measurable.
4. Mampu menerapkan teknologi informasi dan komunikasi (TIK) dalam rangka pelaksanaan pekerjaannya. / Able to implement information and communication technology (ICT) in the context of implementation of his/her work.
5. Menunjukkan sikap tanggung jawab terhadap pekerjaan di bidang keahliannya secara mandiri. / Demonstrating attitude of responsibility on work in his/her field of expertise independently.
6. Bekerja sama untuk dapat memanfaatkan potensi yang dimilikinya secara maksimal. / Working together to be able to make the most of his/her potential.

**Capaian Pembelajaran Mata Kuliah / Course Learning Outcomes**

1. Menguasai konsep dan prinsip sistem kendali cerdas, yaitu kendali fuzzy dan jaringan syaraf tiruan untuk analisis dan perancangan sistem nonlinier, serta algoritma genetika untuk tujuan optimasi dalam perancangan sistem kendali. / Mastering the concepts and principles of intelligent control systems, i.e fuzzy control and neural network for analysis and design of nonlinear systems, and genetic algorithm for optimization purposes in control system design.
2. Mampu merancang sistem kendali cerdas untuk sistem nyata dengan bantuan Matlab/Simulink. / Able to design intelligent control systems for real systems with the help of Matlab / Simulink.
3. Mampu bekerja secara mandiri menunjukkan kinerja yang berkualitas dan terukur melalui tugas perancangan sistem kendali cerdas dan mampu menggunakan perangkat lunak Matlab/Simulink untuk melakukan hasil perancangan simulasi sistem. / Able to work independently showing quality and measurable performance through intelligent control system design tasks and able to use Matlab / Simulink software to perform system simulation design results.
4. Menunjukkan sikap tanggung jawab bekerja pada bidang keahliannya secara mandiri dan dapat bekerja sama dalam tim untuk memperoleh hasil perancangan sistem yang baik. / Demonstrate an attitude of responsibility for work in his area of expertise independently and can work together in teams to obtain good system design results.

**Pokok Bahasan / Contents**

1. Pengantar Konsep Sistem Kontrol Cerdas. / *Introduction to Intelligent Control System Concepts.*
2. Logika Fuzzy dan Sistem Fuzzy. / *Fuzzy Logic and Fuzzy Systems.*
3. Model Fuzzy Takagi-Sugeno. / *Takagi-Sugeno Fuzzy Model.*
4. Aplikasi Kontrol Fuzzy pada Sistem Pendulum-Cart. / *Fuzzy Control Application on the Pendulum-Cart System.*
5. Sintesis Kontrol Fuzzy dengan Teknik Kontrol Lainnya. / *Synthesis of Fuzzy Control with Other Control Techniques.*
6. Jaringan Syaraf Tiruan dan Penerapannya dalam Pengendalian. *Neural Network and Its Application in Control Neural Network and Its Application in Control.*
7. Optimasi menggunakan Teknik Algoritma Genetika. / *Optimization using the Genetic Algorithm Technique.*

**Prasyarat / Pre-requisite**

Pengantar Sistem Kontrol. / *Introduction to Control Systems.*

**Pustaka / Reference**

- [1] Kevin M. Passino dan Stephen Yurkovich, "Kontrol Fuzzy," Addison-Wesley Longman Inc., 1998. / [1] Kevin M. Passino and Stephen Yurkovich, "Fuzzy Control," Addison-Wesley Longman Inc., 1998.
- [2] Kazuo Tanaka, Hua O. Wang, "Desain dan Analisis Sistem Kontrol Fuzzy: Pendekatan Ketimpangan Matriks Linier," John Wiley & Sons, 2001. / [2] Kazuo Tanaka, Hua O. Wang, "Fuzzy Control Systems Design and Analysis: A Linear Matrix Inequality Approach," John Wiley & Sons, 2001.

- [3] Stuart J. Russell dan Peter Norvig, "Kecerdasan Buatan: Pendekatan Modern," Edisi ke-3., Pearson Education, Inc., 2010. / [3] *Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach," 3rd Edition., Pearson Education, Inc., 2010.*
- [4] Melanie Mitchell., Pengantar Algoritma Genetika., pers MIT, 1996. / [4] *Melanie Mitchell., An Introduction to Genetic Algorithms., the MIT press, 1996.*
- [5] Stephen I. Gallant, "Neural Network Learning and Expert Systems," pers MIT, London, 1993. / [5] *Stephen I. Gallant, "Neural Network Learning and Expert Systems," the MIT press, London,1993.*