	INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS) **FAKULTAS TEKNOLOGI ELEKTRO DAN INFORMATIKA CERDAS** **DEPARTEMEN TEKNIK ELEKTRO** **Program Studi Magister (S2) Teknik Elektro**

1	**Nama Mata Kuliah / *Course Name***	:	Smart Grid / *Smart Grid*
2	**Course Code**	:	EE235212
3	**Kredit / *Credits***	:	3 SKS
4	**Semester / *Semester***	:	Wajib

Deskripsi Mata Kuliah / *Course Description*

Mata kuliah ini membahas tentang *smart grid*: difinisi, keuntungan, perkembangan smart grid. Desain arsitektur smart grid. Standard IEC untuk smart grid. Teknologi smart grid: teknologi drive, sumber energi dan storage smart, smart substation, sistem transmisi untuk smart grid, sistem distribusi untuk smart grid, stabilitas sistem smart grid, sistem komunikasi untuk smart grid, monitoring dan diagnostic, teknologi geospatial, manajemen asset, smart meter, consumer demand management, komputasi untuk smart grid, cyber security, dan smart home. Rele pengaman menggunakan metoda konvensional dan kecerdasan buatan meliputi kurva konvensional, non konvesional dan optimasi. Rele pengaman adaptif menggunakan konvenional dan kecerdesan buatan meliputi kurva konvensional, non konventional dan optimasi. Koordinasi rele pengaman over current, over voltage, under voltage, under frequency, over frequency, export import menggunakan metoda konvensional dan kecerdasan buatan.

This course discusses smart grid: definition, advantages, development of smart grid. Smart grid architecture design. IEC standards for smart grid. Smart grid technology: drive technology, smart energy sources and storage, smart substation, transmission system for smart grid, distribution system for smart grid, smart grid system stability, communication system for smart grid, monitoring and diagnostic, geospatial technology, asset management, smart meter, consumer demand management, computing for smart grid, cyber security, and smart home. Protection relays using conventional methods and artificial intelligence include conventional, non-conventional and optimization curves. Adaptive protection relays using conventional and artificial intelligence include conventional, non-conventional and optimization curves. Coordination of over current, over voltage, under voltage, under frequency, over frequency, export import protection relays using conventional methods and artificial intelligence.

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

1. (CPL-02) Mampu mengembangkan dan memecahkan permasalahan ipteks dalam bidang keilmuannya melalui riset dengan pendekatan inter atau multidisiplin

hingga menghasilkan karya inovatif dan teruji, serta mendapat pengakuan nasional dan internasional.

(PLO-02) Able to develop and solve science and technology problems in their scientific fields through research with an inter or multidisciplinary approach to produce innovative and tested work, and receive national and international recognition..

2. (CPL-04) Mampu menguasai konsep, prinsip keilmuan secara komprehensif, prinsip rekayasa, dan pengetahuan faktual tentang Teknologi Informasi untuk mengembangkan prosedur dan strategi yang diperlukan pada analisis dan perancangan sistem terkait bidang Teknik Elektro.

   (PLO-04) Able to master concepts, scientific principles comprehensively, engineering principles, and factual knowledge about Information Technology to develop procedures and strategies required in the analysis and design of systems related to the field of Electrical Engineering.

3. (CPL-08) Mampu mengambil keputusan dalam konteks menyelesaikan masalah pengembangan ilmu pengetahuan dan teknologi yang memperhatikan dan menerapkan nilai humaniora berdasarkan kajian analisis atau eksperimental terhadap informasi dan data.

   (PLO-08) Able to compile scientific concepts and research results based on scientific rules, procedures, ethics, and document theAble to make decisions in the context of solving problems in the development of science and technology that pay attention to and apply humanities values based on analytical or experimental studies of information and data.

Capaian Pembelajaran Mata Kuliah / *Course Learning Outcomes*

1. Mampu memahami definisi, keuntungan, perkembangan smart grid. / *Able to understand the definition, advantages, development of smart grid.*
2. Mampu memahami desain arsitektur dan standard smart grid. / *Able to understand the architectural design and standards of smart grid.*
3. Mampu mengevaluasi aplikasi teknologi smart grid / *Able to evaluate smart grid technology applications.*
4. Mampu mengevaluasi rele menggunakan metoda konvesional dan kecerdasan buatan / *Able to evaluate relays using conventional methods and artificial intelligence*.
5. Mampu mengevaluasi rele adaptif menggunakan metoda konvesional dan kecerdasan buatan / *Able to evaluate adaptive relays using conventional methods and artificial intelligence*.
6. Mampu mengevaluasi koordinasi rele menggunakan metoda konvensional dan kecerdasan buatan / *Able to evaluate relay coordination using conventional methods and artificial intelligence.*

Pokok Bahasan / *Contents*

1. Difinisi, keuntungan, perkembangan smart grid. / *Definition, advantages, development of smart grid.*
2. Desain arsitektur dan standard untuk smart grid. / *Architectural design and standards for smart grid.*
3. Teknologi smart grid: teknologi drive, sumber energi dan storage smart, smart substation, sistem transmisi untuk smart grid, sistem distribusi untuk smart grid, stabilitas sistem smart grid, sistem komunikasi untuk smart grid, monitoring dan diagnostic, teknologi geospatial, manjemen asset, smart meter, consumer demand management, komputasi untuk smart grid, cyber security, dan smart home. / *Smart grid technology: drive technology, smart energy sources and storage, smart substation, transmission system for smart grid, distribution system for smart grid, smart grid system stability, communication system for smart grid, monitoring and diagnostic, geospatial technology, asset management, smart meter, consumer demand management, computing for smart grid, cyber security, and smart home.*
4. Rele pengaman menggunakan metoda konvensional dan kecerdasan buatan meliputi kurva konvensional, non konvesional dan optimasi. / *Protection relay using conventional and artificial intelligence methods including conventional, non-conventional and optimization curves.*
5. Rele pengaman adaptif menggunakan konvensional dan kecerdasan buatan meliputi kurva konvensional, non konventional dan optimasi. / *Adaptive protection relay using conventional and artificial intelligence including conventional, non-conventional and optimization curves.*
6. Koordinasi rele pengaman over current, over voltage, under voltage, under frequency, over frequency, export import menggunakan metoda konvensional dan kecerdasan buatan / *Coordination of overcurrent, over voltage, under voltage, under frequency, over frequency, export import protection relay using conventional and artificial intelligence methods*

Prasyarat / *Pre-requisite*

Analisis Sistem Tenaga / *Power System Analysis*

Pustaka / *Reference*

Utama / *Primary*:

1. Stuart Borlase, "Smart Grids: Infrastructure, Technology, and Solutions", CRC Press Taylor & Francis Group, 2013
2. J. Momoh, *Smart Grid: Fundamentals of Design and Analysis*. John Wiley & Sons, Inc., 2012
3. Charles F. Henville, Paul M. Anderson, et al., *Power System Protection*, 2nd Edition, IEEE Press Series on Power and Energy Systems, Dec 9, 2021

Pendukung / *Supporting*:

4. T. Sato, et. al, *Smart Grid Standards: Specifications, Requirements, and Technologies*. John Wiley & Sons Singapore Pte. Ltd., 2015
5. Nagender Kumar Suryadevara, Subhas Chandra Mukhopadhyay, "Smart Homes: Design, Implementation and Issues", Springer, 2015