



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

1	Nama Mata Kuliah / Course Name : Analisis Sistem Tenaga / <i>Power System Analysis</i>
2	Kode Mata Kuliah / Course Code : EE234511
3	Kredit / Credits : 4 SKS
4	Semester / Semester : 5

Deskripsi Mata Kuliah / Course Description

Mata kuliah analisa sistem tenaga mempelajari dan membahas model sistem tenaga listrik : model komponen-komponen utama, model jaringan dan model matematik ; simulasi dan analisis aliran daya pada sistem tenaga listrik menggunakan metode Gauss Seidel, Newton Raphson dan Fast Decoupled ; simulasi dan analisis hubung singkat baik simetri maupun tidak simetri ; simulasi dan analisis stabilitas transient menggunakan metode kriteria luas sama. / *The Power System Analysis course covers the study and discussion of power system models, including the models of main components, network models, and mathematical models. It also includes simulation and analysis of power flow in electrical power systems using methods like Gauss-Seidel, Newton-Raphson, and Fast Decoupled methods. The course further covers simulation and analysis of both symmetrical and asymmetrical short-circuits, as well as simulation and analysis of transient stability using the equal area criterion method.*

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

CPL 2 Mampu mengkaji dan memanfaatkan ilmu pengetahuan dan teknologi dalam rangka mengaplikasikannya pada bidang teknik elektro, serta mampu mengambil keputusan secara tepat dari hasil kerja sendiri maupun kerja kelompok dalam bentuk laporan tugas akhir atau bentuk kegiatan pembelajaran lain yang luarannya setara dengan tugas akhir melalui pemikiran logis, kritis, sistematis dan inovatif / *Able to examine and utilize knowledge and technology for the purpose of applying them in the field of electrical engineering, and making*

informed decisions based on individual work as well as group work in the form of final reports or other learning activities whose outcomes are equivalent to final projects, through logical, critical, systematic, and innovative thinking.

CPL 3 Mampu mengelola pembelajaran diri sendiri, dan mengembangkan diri sebagai pribadi pembelajar sepanjang hayat untuk bersaing di tingkat nasional, maupun internasional, dalam rangka berkontribusi nyata untuk menyelesaikan masalah dengan mengimplementasikan teknologi informasi dan komunikasi dan memperhatikan prinsip keberlanjutan serta memahami kewirausahaan berbasis teknologi / *Able to manage one's own learning and continually self-develop as a lifelong learner to compete at the national and international levels, with the goal of making a tangible contribution to problem-solving by implementing information and communication technology and considering sustainability principles, as well as understanding technology-based entrepreneurship.*

CPL 7 Mampu mengetahui dan mengaplikasi metode, keahlian sesuai perkembangan terkini di bidang ilmu pengetahuan dan teknologi untuk menyelesaikan permasalahan teknik elektro dengan mengedepankan nilai-nilai universal / *Able to understanding and applying the latest methods and skills in the field of science and technology to solve electrical engineering problems while emphasizing universal values.*

Capaian Pembelajaran Mata Kuliah / Course Learning Outcomes

1. Menjelaskan konsep dasar dalam Analisa Sistem Tenaga / *Explaining the basic concepts in Power System Analysis.*
2. Menjelaskan model komponen utama sistem tenaga listrik, model rangkaian & model matematik dari sistem tenaga listrik / *Describing the main components model of an electrical power system, circuit model, and mathematical model of the electrical power system.*
3. Menjelaskan Simulasi dan Analisis Aliran Daya / *Explaining Simulation and Power Flow Analysis.*
4. Menjelaskan Simulasi dan Analisis Hubung Singkat / *Explaining Simulation and Short Circuit Analysis.*
5. Menjelaskan Simulasi dan Analisis Stabilitas / *Explaining Simulation and Stability Analysis.*

Pokok Bahasan / Contents

1. Konsep dasar analisis sistem tenaga / *Basic concepts of power system analysis*
2. Pemodelan : model komponen utama, diagram segaris, diagram impedansi/admitansi, besaran per unit, model rangkaian (Ybus, Zbus), model matematik (persamaan aliran daya) / *Modeling: main component models, single-line diagrams, impedance/admittance diagrams, per-unit quantities, circuit models (Ybus, Zbus), mathematical models (power flow equations)*
3. Simulasi dan Analisis Aliran Daya : metode Gauss-Seidel, metode Newton Raphson, metode Fast Decoupled / *Simulation and Power Flow Analysis: Gauss-Seidel method, Newton-Raphson method, Fast Decoupled method*

4. Konsep dasar hubung singkat pada sistem tenaga listrik / *Basic concepts of short-circuit analysis in power systems*
5. Metode Zbus yang diterapkan pada Simulasi dan Analisis Hubung Singkat 3 fasa simetri / *Zbus method applied to 3-phase symmetrical short-circuit simulation and analysis*
6. Teori Komponen Simetri / *Symmetrical Component Theory*
7. Simulasi dan Analisis Hubung Singkat menggunakan teori Komponen Simetri. / *Short-Circuit Simulation and Analysis using Symmetrical Component Theory*
8. Konsep Dasar stabilitas pada sistem tenaga listrik / *Basic concepts of stability in power systems*
9. Simulasi dan Analisis Stabilitas Transient menggunakan metode kriteria luas sama / *Transient Stability Simulation and Analysis using the Equal Area Criterion method*

Prasyarat / Pre-requisite

Rangkaian Listrik, Metode Numerik / *Electric Circuits, Numerical Methods*

Pustaka / Reference

4. Teaching Module, "Power System Analysis", Ontoseno Penangsang, 2022
5. John J. Grainger, William D. Stevenson, Jr., "Power System Analysis", McGraw-Hill Inc, 1994
6. Hadi Saadat, "Power System Analysis", McGraw-Hill Inc, 1999

Mata Kuliah Course	Nama MK <i>Name</i>	: Analisis Sistem Tenaga : <i>Power System Analysis</i>
	Kode MK <i>Code</i>	: EE184511
	Kredit <i>Credits</i>	: 4 sks
	Semester <i>Semester</i>	: V (Wajib) : <i>V (Compulsory)</i>
	Beban Belajar <i>Workload</i>	: Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu : <i>Lectures : 4 x 50 = 200 min/week</i> <i>Exercises/Assignments : 4 x 60 = 240 min/week</i> <i>Self learning : 4 x 60 = 240 min/week</i>
	Tingkatan <i>Module Level</i>	: Sarjana (S1) : <i>Undergraduate</i>
	Penanggung Jawab <i>PIC</i>	: Prof. Dr.Ir. Adi Soeprijanto, MT : Dr. Rony Seto Wibowo, ST, MT Prof. Ir. Ontoseno Penangsang, M.Sc, Ph.D
	Pengajar <i>Lecturer</i>	: Dr. Ir. Totok Mujiono, MI.Kom.
	Bahasa <i>Language</i>	: Bahasa Indonesia dan Bahasa Inggris : <i>Bahasa Indonesia and English</i>
	Persyaratan dan Peraturan <i>Requirement and Regulation</i>	: Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian : <i>A student must have attended at least 75% of the lectures to sit in the exams</i>

Deskripsi Mata Kuliah

Description of Course

Mata kuliah analisis sistem tenaga membahas perhitungan dan simulasi aliran daya pada sistem tenaga listrik menggunakan beberapa metode seperti metode Gauss Seidel, Newton Raphson dan Fast Decoupled. Selain itu, mata kuliah ini membahas analisis hubung singkat baik simetri maupun tidak simetri. Setelah itu, analisis kestabilan transient menggunakan metode kriteria sama luas akan dibahas.

Power system analysis discusses power flow analysis and its calculation using Gauss Seidel, Newton Raphson and Fast Decoupled Method. Moreover, this subject discusses symmetrical and asymmetrical short circuit analysis. This subject also discuss about transient stability analysis using equal area criterion.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-01) Mampu menerapkan ilmu pengetahuan alam dan matematika pada bidang teknik elektro

(PLO-1) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-10) Mampu mengetahui dan menyikapi perkembangan terkini dibidang ilmu pengetahuan dan teknologi dengan mengedepankan nilai-nilai universal

(PLO-10) Capable to know and respond to the latest developments in science and technology by promoting universal values

(CPL-11) Mampu menerapkan metode, ICT, dan perangkat modern dalam penyelesaian permasalahan dibidang teknik elektro

(PLO-11) Capable to apply methods, ICT, and modern devices in solving problems in the field of electrical engineering

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep simulasi sistem tenaga listrik ac 3 fasa berbasis pada perhitungan rangkaian 1 fasa dalam keadaan steady state/transient dan simetri/tak simetri.

(CLO-01) Master the concept of simulation of a three phase ac power system based on the calculation of the single phase circuit in the steady state, transient and symmetry and asymmetry.

(CPMK-02) Mampu menganalisis sistem tenaga listrik ac 3 fasa dalam keadaan steady state/transient dan simetri/tak simetri menggunakan software MATLAB.

(CLO-02) Able to analyze the three phase ac power system in steady state and transient for symmetry and asymmetry using MATLAB.

(CPMK-03) Mampu menggunakan software MATLAB untuk melakukan simulasi dan analisis sistem tenaga listrik.

(CLO-03) Able to use MATLAB software to carry out simulation and analysis of electric power systems.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahlian Simulasi dan Analisis sistem tenaga listrik secara mandiri.

(CLO-04) Demonstrate an attitude of responsibility for work in the field of expertise in the simulation and analysis of electric power systems independently.

(CPMK-05) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.

(CLO-05) Work together to make the most of their potential.

Topik/Pokok Bahasan

Main Subjects

1. Konsep dasar analisis sistem tenaga
Basic concept of power system analysis
2. Pemodelan : model komponen utama, diagram segaris, diagram impedansi/admitansi, besaran per unit, model rangkaian (Ybus, Zbus), model matematik (persamaan aliran daya)
Modeling: main component model, line diagram, impedance / admittance diagram, quantity per unit, circuit model (Ybus, Zbus), mathematical model (power flow equation)
3. Simulasi dan Analisis Aliran Daya : metode Gauss-Seidel, metode Newton Raphson, metode Fast Decoupled

Power Flow Simulation and Analysis: Gauss-Seidel method, Newton Raphson method, Fast Decoupled method

4. Konsep dasar hubung singkat pada sistem tenaga listrik
The basic concept of short circuit in the electric power system
5. Metode Zbus yang diterapkan pada Simulasi dan Analisis Hubung Singkat 3 fasa simetri
The Zbus method is applied to the simulation of 3 phase symmetry and short circuit analysis
6. Teori Komponen Simetri
Symmetry Component Theory
7. Simulasi dan Analisis Hubung Singkat menggunakan teori Komponen Simetri.
Simulation and Analysis of Short Circles using the Symmetry Component theory.
8. Konsep Dasar stabilitas pada sistem tenaga listrik.
The basic concept of stability in the electric power system.
9. Simulasi dan Analisis Stabilitas.
Stability Simulation and Analysis.

Pembelajaran dan ujian

Study and examination

- Latihan di kelas
In-class exercises
- Tugas 1, 2, 3
Assignment 1, 2, 3
- Ujian tengah semester
Mid-term examination
- Ujian akhir semester
Final examination

Pustaka

Reference(s)

- [1] John J. Grainger, William D. Stevenson, Jr., "Power System Analysis", McGraw-Hill Inc, 1994
- [2] Hadi Saadat, "Power System Analysis", McGraw-Hill Inc, 1999
- [3] M.E. El-Hawary, "Electric Power Systems : Design and Analysis", Reston Publishing Company, 1983
- [4] C.A. Gross, " Power System Analysis", 2nd Edition, John Wiley & Sons, 1983
- [5] Turan Gonen, "Modern Power System Analysis", John Wiley & Sons, 1988

Prasyarat

Prerequisite(s)

EW184003 Rangkaian Listrik

EW184003 Electric Circuits