



**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> : Fenomena Transien Tegangan Tinggi / <i>High Voltage Transient Phenomenon</i>
<b>2</b>	<b>Kode Mata Kuliah / Course Code</b> : EE234715
<b>3</b>	<b>Kredit / Credits</b> : 3 SKS
<b>4</b>	<b>Semester / Semester</b> : 0

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

Mata kuliah ini membahas fenomena transien yang dapat terjadi dalam sistem tenaga listrik khususnya yang berkaitan dengan tegangan tinggi, seperti : switching, petir, dan kejadian transien dengan durasi cepat (kurang dari 1 detik). Pembahasan meliputi gejala timbulnya fenomena, penyebab, dampak terhadap peralatan listrik dan keselamatan manusia hingga metode pencegahan secara umum. / *This course covers transient phenomena that can occur in electrical power systems, especially those related to high voltage, such as switching events, lightning, and fast-duration transients (less than 1 second). The discussion includes the appearance of these phenomena, their causes, their impact on electrical equipment and human safety, and general prevention methods.*

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

CPL 1 Mampu menunjukkan sikap dan karakter yang mencerminkan: ketakwaan kepada Tuhan Yang Maha Esa, etika dan integritas, berbudi pekerti luhur, peka dan peduli terhadap masalah sosial dan lingkungan, menghargai perbedaan budaya dan kemajemukan, menjunjung tinggi penegakan hukum mendahulukan kepentingan bangsa dan masyarakat luas, melalui kreatifitas dan inovasi, ekselensi, kepemimpinan yang kuat, sinergi, dan potensi lain yang dimiliki untuk mencapai hasil yang maksimal / *Being able to demonstrate attitudes and characteristics that reflect: devotion to the One Almighty God, ethics and integrity, noble virtues, sensitivity and care towards social and environmental issues, appreciation of cultural diversity and inclusivity, upholding the rule of law*

*with a priority on the interests of the nation and the wider community, through creativity and innovation, excellence, strong leadership, synergy, and other potentials possessed to achieve maximum results.*

CPL 6 Mampu mengkaji dan memanfaatkan matematika, ilmu pengetahuan alam dan teknologi serta mengidentifikasi, memformulasikan dan menyelesaikan permasalahan di bidang teknik elektro / *Able to evaluate and utilize mathematics, natural sciences, and technology, as well as identify, formulate, and solve problems in the field of electrical engineering.*

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.*

CPL 9 Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan / *Able to effective communication, both in written and oral forms.*

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

1. Mampu menjelaskan konsep transien tegangan lebih / *Able to explain the concept of voltage surges.*
2. Mampu menjelaskan fenomena tegangan lebih switching / *Able to explain the voltage surges due to switching phenomena.*
3. Mampu menjelaskan tegangan lebih petir / *Able to explain lightning-induced voltage surges.*
4. Mampu menjelaskan konsep performansi saluran udara tegangan tinggi terhadap tegangan lebih transien / *Able to explain the concept of high-voltage air transmission line performance concerning transient voltage surges.*
5. Mampu membuat sistem perlindungan pada manusia, bangunan dan peralatan listrik terhadap petir sederhana / *Able to create a simple protection system for humans, buildings, and electrical equipment against lightning.*
6. Mampu menjelaskan fenomena transien akibat ketidaklinieran peralatan seperti inrush current dan feroresonansi / *Able to explain transient phenomena caused by nonlinear equipment, such as inrush current and feroresonance.*

#### **Pokok Bahasan / Contents**

1. Konsep dasar rangkaian RLC dan pemodelan sistem / *Basic Concepts of RLC Circuits and System Modeling*
2. Konsep dan klasifikasi fenomena transien dalam sistem tenaga listrik / *Concepts and Classification of Transient Phenomena in Power Systems*
3. Prinsip kerja Circuit Breaker (CB) dan fenomena switching / *Operation Principles of Circuit Breakers (CB) and Switching Phenomena*
4. Proses terjadinya fenomena petir dan sistem proteksi terhadap petir / *Lightning Phenomenon and Lightning Protection Systems*
5. Shielding failure dan back flashover / *Shielding Failure and Back Flashover*
6. Travelling wave / *Traveling Waves*

7. Proteksi peralatan tegangan tinggi dan gardu induk / *High Voltage Equipment and Substation Protection*
8. Prinsip kerja surge arrester / *Principles of Surge Arrester Operation*
9. Fenomena inrush current, ferroresonance / *Inrush Current Phenomenon, Ferroresonance*
10. Simulasi transien dengan software EMTP/ATPDraw / *Transient Simulation with EMTP/ATPDraw Software*

**Prasyarat / Pre-requisite**

Teknik Tegangan Tinggi / *High Voltage Engineering*

**Pustaka / Reference**

1. JC. Das, "Transients in Electrical Systems: Analysis, Recognition, and Mitigation", McGraw-Hill, 2010
2. Ametani, Akihiro, et.al, "Power System Transients: Theory and Applications", CRC Press, 2017
3. Eiichi Haginomori, "Power System Transient Analysis: Theory and Practice using Simulation Programs (ATP-EMTP)", Wiley, 2016
4. DEHN+SOHNE, "Lightning Protection Guide", DEHN, 2014
5. Martinez-Velasco, Juan, "Transient Analysis of Power Systems: Solution Techniques, Tools, and Applications", IEEE Press, 2015