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|  | **UNIVERSITAS SUMATERA UTARA (USU)**  **FAKULTAS TEKNIK**  **DEPARTEMEN TEKNIK ELEKTRO** | | | | | | | | **Kode Dokumen** |
| **RENCANA PEMBELAJARAN SEMESTER** | | | | | | | | | |
| **MATA KULIAH (MK)** | | | **KODE** | **Rumpun MK** | **BOBOT (sks)** | | **SEMESTER** | **Tgl Penyusunan** | |
| **Gardu Induk dan Peralatan Tegangan Tinggi** | | | TEE3208 |  | **2** |  |  | 7 AGUSTUS 2022 | |
| **OTORISASI / PENGESAHAN** | | | **Dosen Pengembang RPS** | | **Koordinator RMK** | | **Ka Prodi** | | |
| Ir. Hendra ZulkarnaIn, MT | | Ir. Hendra ZulkarnaIn, MT | | Suherman, ST., M.Comp., Ph.D | | |
| **Capaian Pembelajaran** | | **CPL-PRODI yang dibebankan pada MK** | | |  | | | | |
| CPL-1 | Mampu menerapkan pengetahuan matematika, ilmu pengetahuan alam/atau material, teknologi informasi dan kerekayasaan untuk mendapatkan pemahaman menyeluruh tentang prinsip-prinsip Teknik Elektro. | | | | | | |
| CPL-2 | Mampu mendesain komponen, sistem dan/atau proses untuk memenuhi kebutuhan yang diharapkan oleh masyarakat dengan dihadapkan pada batasan realistik yang meliputi aspek hukum, ekonomi, lingkungan, sosial, politik, kesehatan dan keselamatan, keberlanjutan. | | | | | | |
| CPL-3 | Mampu mendesain eksperimen laboratorium dan/atau lapangan serta menganalisis dan mengartikan data untuk memperkuat penilaian teknik khususnya dalam bidang Teknik Elektro. | | | | | | |
| CPL-4 | Mampu menyelesaikan permasalahan teknik khususnya dalam bidang Teknik Elektro secara bertanggungjawab dan memenuhi etika profesi. | | | | | | |
| CPL-5 | Mampu menerapkan metode, keterampilan dan perangkat teknik modern yang diperlukan untuk praktek profesi Teknik Elektro. | | | | | | |
| CPL-6 | Mampu berkomunikasi secara efektif, baik lisan maupun tulisan. | | | | | | |
| CPL-7 | Mampu mengevaluasi tugas-tugas dalam batasan yang ada secara disiplin dan menyeluruh. | | | | | | |
| CPL-8 | Mampu untuk bekerja dalam tim lintas disiplin dan multikultural serta global internasional. | | | | | | |
| CPL-9 | Mampu untuk bertanggung jawab kepada masyarakat dan mematuhi etika profesi dalam menyelesaikan permasalahan Teknik Elektro. | | | | | | |
| CPL-10 | Memiliki kapasitas pembelajaran sepanjang hayat termasuk akses pengetahuan yang relevan tentang isu-isu terkini. | | | | | | |
| CPL-11 | Mampu mengidentifikasi potensi daerah di Sumatera Utara dan menerapkan inovasi, metode, keterampilan, dan perangkat teknik elektro yang relevan untuk mengembangkan potensi daerah tersebut. | | | | | | |
| CPL-12 | Mampu mendesain sistem dan/atau proses untuk memanfaatkan energi baru dan terbarukan sebagai sumber energi listrik alternatif dari potensi sumber daya lokal dan nasional dengan wawasan global. | | | | | | |
| **Capaian Pembelajaran Mata Kuliah (CPMK)** | | |  | | | | |
| CPMK 1 | Memahami fungsi Gardu Induk, alasan tingginya tegangan sistem transmisi dan distribusi, gejala medan tinggi serta masalah yang timbul akibat tingginya tegangan sistem. | | | | | | |
| CPMK 2 | Memahami jenis-jenis peralatan tegangan tinggi yang digunakan pada gardu induk dan saluran transmisi | | | | | | |
| CPMK 3 | Memahami prinsip kerja dan spesifikasi peralatan tegangan tinggi yang digunakan pada gardu induk dan saluran tegangan tinggi | | | | | | |
| CPMK 4 | Memahami prinsip perencanaan dan aplikasik peralatan tegangan tinggi yang akan dipergunakan pada sebuah gardu induk dan saluran transmisi | | | | | | |
| **Peta CPL – CPMK** | | |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | **CPL 01** | **CPL 02** | **CPL 03** | **CPL 04** | **CPL 05** | **CPL 06** | **CPL 07** | **CPL 08** | **CPL 09** | **CPL 10** | **CPL 11** | **CPL 12** | | CPMK 1 |  | **V** |  |  |  |  |  |  |  |  |  |  | | CPMK 2 |  |  |  | **V** |  |  |  |  |  |  |  |  | | CPMK 3 |  |  |  |  | **V** |  |  |  |  |  |  |  | | CPMK 4 |  |  |  |  |  |  |  |  | **V** |  |  |  | | | | | | | | |
| **Diskripsi Singkat MK** | | Mata kuliah Gardu Induk dan Peralatan Tegangan Tinggi membahas fungsi Gardu Induk pada sistem tenaga listrik, jenis-jenis gardu induk serta prinsip kerja dan spesifikasi peralatan tegangan tinggi yang digunakan pada gardu induk dan saluran tegangan tinggi | | | | | | | |
| **Bahan Kajian:** Materi pembelajaran | | Gardu Induk dan Tegangan Tinggi: Tegangan Tinggi Gardu Induk dan Transmisi, Masalah Akibat Tingginya Tegangan Sistem, Gardu Induk, Komponen Gardu Induk, Sistem dan Jenis-Jenis Gardu Induk; Pemutus Daya: Fungsi Pemutus Daya, Hubungan Relay Dengan Pemutus Daya, Proses Pemutusan Daya, Ionisasi, Deionisasi,Emisi, Pembentukan Busur Api, Pemadaman Busur Api, Tegangan Pemulihan Kontak; Pemutus Daya (Lanjutan): Jenis-Jenis Pemutus Daya, Pertimbangan Dalam Pemilihan Pemutus Daya, Kapasitas Pemutus Daya, Tegangan Pemutus Daya; Konduktor: Bahan dan Jenis Konduktor, Kawat Telanjang, Kabel Tenaga, Parameter Konduktor, Pemilihan Ukuran Konduktor, Rel Daya; Pelindung Tegangan Lebih Surja: Jenis-Jenis Tegangan Lebih, Teori Gelombang Berjalan, Prinsip Kerja Alat Pelindung Tegangan Lebih, Kawat Tanah, Sela Batang; Pelindung Tegangan Lebih Surja (Lanjutan): Lightning Arrester Ekspulsi: Lightning Arrester Katub Sela Pasif, Lightning Arrester Katub Sela Aktif, Lightning Arrester Tanpa Sela Percik, Tegangan Pengenal Lightning Arrester, Klasifikasi dan Spesifikasi Light; Sakelar Pemisah: Konstruksi Sakelar Pemisah, Kerja Sakelar Pemisah, Jenis-Jenis Sakelar Pemisah, Interlock Sakelar Pemisah, Pengenal Sakelar Pemisah, Pengujian Sakelar Pemisah, Pemilihan Sakelar Pemisah; Trafo Tegangan: Prinsip Kerja Trafo Tegangan, Trafo Tegangan Magnetik, Trafo Tegangan Kapasitif, Galat (Error), Pengenal Trafo Tegangan, Beban Trafo Tegangan, Pemilihan Trafo Tegangan, Pengujian Trafo Tegangan, Spesifikasi Trafo Tegangan; Trafo Arus: Fungsi dan Prinsip Kerja Trafo Arus, Galat (Error), Galat Komposit, Burden Trafo Arus, Faktor Kejenuh, Ketahanan Arus Hubung Singkat, Jenis Trafo Arus, Tingkat Isolasi Trafo Arus, Pertimbangan Pemilihan Trafo Arus, Pengujian Trafo Arus; Isolator dan Bushing: Fungsi Isolator, Konstruksi Isolator, Parameter Isolator, Jenis-Jenis Isolator Udara, Bahan Dielektrik Isolator dan Bushing; Isolator dan Bushing (Lanjutan): Karakteristik Elektrik, Karakteristik Mekanik, Isolator Terpolusi, Distribusi Tegangan Isolator Rantai, Bushing; Mahasiswa dapat mengerjakan latihan tentang kapasitor tegangan tinggi: jenis-jenis kapasitor, konstruksi sel kapasitor, daya & energi kapasitor, kapasitor gulung , rancangan suatu kapasitor; Mahasiswa memahami perkembangan teori kapasitor tegangan tinggi (lanjutan): konstruksi kapasitor, sekering kapasitor bank, kondisi operasi kapasitor, spesifikasi kapasitor, pengujian kapasito, trafo daya: prinsip kerja trafo daya, susunan dan penyambungan kumparan, isolasi kumparan tegangan tinggi, susunan isolasi mayor trafo, distribusi tegangan pada belitan, metode pendinginan pada trafo, mengujian trafo daya | | | | | | | |
| **Pustaka** | | **Utama:** |  | | | | | | |
| 1. Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017 2. Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979 | | | | | | | |
| **Pendukung:** |  | | | | | | |
| 1. Kuffel E. & Zaeng W.S., “High Voltage Engineering”, Pergamon Press, Oxford, 2nd ed. 2000 2. Gallagher T.J., “High Voltage Measurement, Testing and Design”, John Wiley & sons, New York, 1983 3. Razevig D.H., “High Voltage Engineering”, Khanna Publisher, Delhi, 1982 4. Kreuger F.H.. “Industrial High Voltage”, Delft University Press, 1992 | | | | | | | |
| **Dosen Pengampu** | |  | | | | | | | |
| **Matakuliah syarat** | |  | | | | | | | |

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| **Mg Ke-** | **Kemampuan akhir tiap tahapan belajar (Sub-CPMK)** | **Penilaian** | | **Bantuk Pembelajaran;**  **Metode Pembelajaran;**  **Penugasan Mahasiswa;**  **[ Estimasi Waktu]** | | **Materi Pembelajaran**  **[Pustaka]** | **Bobot Penilaian (%)** |
| **Indikator** | **Kriteria & Teknik** |
| **(1)** | **(2)** | **(3)** | **(4)** | **Tatap Muka(5)** | **Daring (6)** | **(7)** | **(8)** |
| 1 | Mahasiswa menguasai teori alasan tegangan transmisi dan distribusi tinggi, masalah yang timbul akibat tingginya tegangan saluran transmisi, Fungsi Gardu Induk, Peralatan Gardu Induk, Jenis-jenis gardu Induk berdasarkan fungsinya, Jenis Gardu Induk berdasarkan tinggi tegangan, Jenis Gardu Induk berdasarkan penempatan peralatan, Jenis Gardu Induk berdasarkan jenis isolasi, Kelebihan GIS (Gas Insulated Substation/ Switchgear) dibanding AIS, Gas SF6 | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Alasan tegangan transmisi dan distribusi tinggi, masalah yang timbul akibat tingginya tegangan saluran transmisi, Fungsi Gardu Induk, Peralatan Gardu Induk, Jenis-jenis gardu Induk berdasarkan fungsinya, Jenis Gardu Induk berdasarkan tinggi tegangan, Jenis Gardu Induk berdasarkan penempatan peralatan, Jenis Gardu Induk berdasarkan jenis isolasi, Kelebihan GIS (Gas Insulated Substation/ Switchgear) dibanding AIS, Gas SF6  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 2 | Mahasiswa memahami pengertian Rel Daya (bus bar) Gardu Induk, Pemilihan Rel Daya, Jarak Rel Daya, Strain-bus dan Rigid-bus, Konfigurasi Busbar pada Gardu Induk (Gardu Induk sistem single busbar, Gardu Induk sistem Sectionalized Bus, Gardu Induk sistem Main and Transfer Bus, Gardu Induk sistem ring busbar, Gardu Induk sistem satu setengah (Breaker and a Half) busbar, Gardu Induk sistem double busbar) | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Rel Daya (bus bar) Gardu Induk, Pemilihan Rel Daya, Jarak Rel Daya, Strain-bus dan Rigid-bus, Konfigurasi Busbar pada Gardu Induk (Gardu Induk sistem single busbar, Gardu Induk sistem Sectionalized Bus, Gardu Induk sistem Main and Transfer Bus, Gardu Induk sistem ring busbar, Gardu Induk sistem satu setengah (Breaker and a Half) busbar, Gardu Induk sistem double busbar)  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 3 | Mahasiswa menguasai teori dan prinsip pemutus daya, fungsi pemutus daya, operasi pemutus daya , proses pemutusan rangkaian, proses pembentukan busur api, pemadaman busur api, tegangan pemulihan kontak, Pemutus Daya Udara (Air Circuit Breaker), Pemutus Daya Udara Tekanan (Air Blast Circuit Breaker), Pemutus Daya Minyak (Oil Circuit Breaker), Pemutus Daya Vakum (Vacuum Circuit Breaker), Pemutus Daya SF6 serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Prinsip pemutus daya, fungsi pemutus daya, operasi pemutus daya , proses pemutusan rangkaian, proses pembentukan busur api, pemadaman busur api, tegangan pemulihan kontak, Pemutus Daya Udara (Air Circuit Breaker), Pemutus Daya Udara Tekanan (Air Blast Circuit Breaker), Pemutus Daya Minyak (Oil Circuit Breaker), Pemutus Daya Vakum (Vacuum Circuit Breaker), Pemutus Daya SF6  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 8% |
| 4 | Mahasiswa mampu menjelaskan teori dan fungsi konduktor, jenis dan bahan konduktor, kawat telanjang, kabel tenaga tegangan tinggi, conductor accessories, efek kulit, resistansi, kuat hantaran arus, pertimbangan pemilihan konduktor, conductor size, parameter konduktor, pemilihan ekonomi ukuran konduktor serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Fungsi konduktor, jenis dan bahan konduktor, kawat telanjang, kabel tenaga tegangan tinggi, conductor accessories, efek kulit, resistansi, kuat hantaran arus, pertimbangan pemilihan konduktor, conductor size, parameter konduktor, pemilihan ekonomi ukuran konduktor  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 5 | Mahasiswa dapat menjelaskan pengertian isolator dan bushing, fungsi isolator, jenis-jenis isolator, konstruksi isolator, persyaratan isolator, parameter isolator, jenis-jenis isolator udara dan bahan dielektrik isolator, karakteristik listrik isolator, karakteristik mekanik isolator, isolator terpolusi, penentuan jarak rambat isolator serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Pengertian isolator dan bushing, fungsi isolator, jenis-jenis isolator, konstruksi isolator, persyaratan isolator, parameter isolator, jenis-jenis isolator udara dan bahan dielektrik isolator, karakteristik listrik isolator, karakteristik mekanik isolator, isolator terpolusi, penentuan jarak rambat isolator  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 6 | Mahasiswa memahami metode pengukuran Bobot Polusi Isolator, metode ESDD, metode NSDD, distribusi tegangan isolator rantai, Pemerataan Distribusi Tegangan Isolator Rantai, bushing serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  MahasiswaPengukuran Bobot Polusi Isolator, metode ESDD, metode NSDD, distribusi tegangan isolator rantai, Pemerataan Distribusi Tegangan Isolator Rantai, bushing  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 7 | Mahasiswa dapat memahami fungsi sakelar pemisah, konstruksi sakelar pemisah, kerja sakelar pemisah, jenis-jenis sakelar pemisah, interlock sakelar pemisah, pengenal sakelar pemisah, pengujian sakelar pemisah, pemilihan sakelar pemisah, fuse cut out, kerja dan fungsi fuse cut out serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Fungsi sakelar pemisah, konstruksi sakelar pemisah, kerja sakelar pemisah, jenis-jenis sakelar pemisah, interlock sakelar pemisah, pengenal sakelar pemisah, pengujian sakelar pemisah, pemilihan sakelar pemisah, fuse cut out, kerja dan fungsi fuse cut out  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 8 | UJIAN TENGAH SEMESTER |  |  |  |  |  |  |
| 9 | Mahasiswa memahami jenis-jenis tegangan dan tegangan lebih, mekanisme petir, teori gelombang berjalan, prinsip kerja alat pelindung tegangan lebih serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Jenis-jenis tegangan dan tegangan lebih, mekanisme petir, teori gelombang berjalan, prinsip kerja alat pelindung tegangan lebih  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 10 | Mahasiswa memahami teori dan prinsip kerja kawat tanah, sela batang, lightning arrester ekspulsi, lightning arrester katub sela pasif, lightning arrester katub sela aktif serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Teori kawat tanah, sela batang, lightning arrester ekspulsi: lightning arrester katub sela pasif, lightning arrester katub sela aktif  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 11 | Mahasiswa memahami prinsip kerja lightning arrester tanpa sela percik, tegangan pengenal Lightning arrester, klasifikasi dan spesifikasi lightning arrester, lokasi penempatan lightning arrester, sela batang serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Lightning arrester tanpa sela percik, tegangan pengenal Lightning arrester, klasifikasi dan spesifikasi lightning arrester, lokasi penempatan lightning arrester, sela batang  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 12 | Mahasiswa memahami prinsip kerja dan fungsi trafo daya, spesifikasi trafo daya, prinsip trafo daya, rugi-rugi trafo daya, jenis-jenis inti trafo, susunan dan penyambungan kumparan trafo daya, isolasi kumparan tegangan tinggi, susunan isolasi mayor trafo, distribusi tegangan pada belitan, metode pendinginan pada trafo, mengujian trafo daya serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Prinsip kerja dan fungsi trafo daya, spesifikasi trafo daya, prinsip trafo daya, rugi-rugi trafo daya, jenis-jenis inti trafo, susunan dan penyambungan kumparan trafo daya, isolasi kumparan tegangan tinggi, susunan isolasi mayor trafo, distribusi tegangan pada belitan, metode pendinginan pada trafo, mengujian trafo daya  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 8% |
| 13 | Mahasiswa memahami prinsip kerja jenis-jenis trafo tegangan, trafo tegangan magnetik, trafo tegangan kapasitif, galat (error), pengenal trafo tegangan, beban trafo tegangan, pemilihan trafo tegangan, pengujian trafo tegangan, spesifikasi trafo tegangan serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Prinsip kerja jenis-jenis trafo tegangan, trafo tegangan magnetik, trafo tegangan kapasitif, galat (error), pengenal trafo tegangan, beban trafo tegangan, pemilihan trafo tegangan, pengujian trafo tegangan, spesifikasi trafo tegangan  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 14 | Mahasiswa memahami trafo arus, jenis trafo arus, prinsip kerja trafo arus, galat (error), faktor kejenuhan dan tegangan lutut, pengenal trafo arus, pengujian trafo arus serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Trafo arus, jenis trafo arus, prinsip kerja trafo arus, galat (error), faktor kejenuhan dan tegangan lutut, pengenal trafo arus, pengujian trafo arus  **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 15 | Mahasiswa memahami pegunaan dan fungsi kapasitor tegangan tinggi, konstruksi kapasitor tegangan tinggi, daya dan energi kapasitor, peluahan pada sel kapasitor, kapasitor gulung , rancangan suatu kapasitor gulung, konstruksi kapasitor, sekering kapasitor bank, kondisi operasi kapasitor, spesifikasi kapasitor, pengujian kapasitor, koneksi kapasitor tiga fasa, proteksi kapasitor bank serta mampu menerapkan aplikasinya dalam bidang teknik elektro | 1. *The accuracy in providing the information required* 2. *The student’s fluency in reading the memo (spelling, intonation, and speed)* 3. *The correctness of the student’s answers* | **Kriteria:**  *Marking Scheme*  **Bentuk:**  *Worksheet* (Non-Tes)   1. *Reading the memo provided.* 2. *Responding to the opening questions given.* 3. *Completing the table (problem-solution) according to the information in the memo.* 4. *Finding the word or phrase with similar meaning (synonym) according to the information in the memo.*   *Classifying the words or phrases with the correct headings.* | BM [(1x(2x60”)]  **Kegiatan:**   1. *Reviewing the previous lessons.* 2. *Reading the added learning materials.* 3. *Recording the presence.* 4. *Responding to opening questions in the ‘Discussion Forum’ section.* 5. *Submitting the assigned tasks.*   PT [(1x(2x60”)]  **Task 3:**  *Restating the information obtained in the form of an a-150-words paragraph.*  **Moda (*Learning Management System*):**  [elearning@usu.ac.id](mailto:elearning@usu.ac.id) | TM [(1x(2x50”)]  **Kegiatan:**   1. *Making notes of the learning materials explained.* 2. *Responding to the questions or instructions given.* 3. *Completing all the provided exercises individually.* 4. *Discussing the exercises completed.*   **Media:**  *Power Point Presentation (PPT)*  *Zoom Meeting*  *Audio Recording*  *English Handout*  **Metode Pembelajaran:**   1. *Online Lecture* 2. *Discussion* 3. *Self-Paced*   *Learning* | **Pokok Bahasan:**  Pegunaan dan fungsi kapasitor tegangan tinggi, konstruksi kapasitor tegangan tinggi, daya dan energi kapasitor, peluahan pada sel kapasitor, kapasitor gulung , rancangan suatu kapasitor gulung, konstruksi kapasitor, sekering kapasitor bank, kondisi operasi kapasitor, spesifikasi kapasitor, pengujian kapasitor, koneksi kapasitor tiga fasa, proteksi kapasitor bank    **Referensi:**   1. **Bonggas L. Tobing, “Peralatan Tegangan Tinggi:, Erlangga, 2017** 2. **Partap Singh & P.V. Gupta, “Substation Design and Equipments”, Dhanpat Rain & sons, Delhi, 1979** | 7% |
| 16 | UJIAN AKHIR SEMESTER |  |  |  |  |  |  |
|  | Total | | | | | | **100** |