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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** | |
| **Material Elektroteknik** | | | TEE3107 |  | **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 | Mengenal klasifikasi umum bahan keteknikan khusus bidang Teknik Elektro. | | | | | | |
| CPMK 2 | Memahami struktur atom, konfigurasi elektron dan dasar pembentukan sifat material elektroteknik. | | | | | | |
| CPMK 3 | Memahami pembentukan dan sifat material konduktor, material semikonduktor, material dielektrik/isolasi dan material magnetik. | | | | | | |
| CPMK 4 | Mampu mengaplikasikan penggunaan material teknik dan material elektroteknik pada bidang Teknik Elektro. | | | | | | |
| **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 Material elektroteknik membahas tentang material teknik dan material elektroteknik yang meliputi dasar pembentukan sifat material akibat berbagai konfigurasi susunan atom, pembentukan dan sifat material konduktor, material semikonduktor, material dielektrik/isolasi dan material magnetik serta aplikasinya dalam bidang Teknik Elektro. | | | | | | | |
| **Bahan Kajian:** Materi pembelajaran | | Klasifikasi material berdasar fisik material; klasifikasi material berdasar sifat listik material; properti dari material; model atom; mekanika kuantum; bentuk orbital; konfigurasi elektron; ikatan atom; Struktur Kristal Logam; Pita Energi; material konduktor; sifat material konduktor; efek kulit; Non Linear Conductor; Efek Seebeck dan Thermocouple; Efek Hall; Potensial Kontak; Thermistor dan Resistance Temperature Detector (RTD); Superkonduktivitas; Beberapa material konduktor; Material Semikonduktor; Semikonduktor Intrinsik; Konduktivitas pada semikonduktor intrinsik; Semikonduktor Ekstrinsik; Pengaruh cahaya / radiasi pada semikonduktor; Pengaruh temperatur pada semikonduktor; Luminescence; P-N Junction Dioda; Forward Biasing; Reverse Biasing (Zener Diode); Karakteristik Volt-Amper (V/I) dari dioda; Schottcky Diode; Photo Diode; Solar Cell (photo Voltaic); Transistor; material dielektrik/isolasi, Polarisasi, Rugi-rugi dielektrik, Konstanta Rugi-rugi dielektrik (𝐭𝐚𝐧 𝜹), arus bocor (Leakage Current), Resistansi Isolasi Kabel, Kekuatan Dielektrik dan Tegangan Tembus; Beberapa fenomena lain bahan isolasi; Teori Tembus Linstrik Dielektrik Gas (Townsend); Teori Tembus Listrik Dielektrik Padat; Teori tembus dielektrik cair; Piezeoelektrisitas; Efek Pyroelektrik; Material Ferroelektrik; Photoresistor; Klasifikasi material isolasi berdasarkan panas; Contoh-contoh material dielektrik/isolasi; pengertian material magnetik, Dipol magnetik, Magnetisasi, Klasifikasi material magnetik, Material Ferromagnetik, Material Paramagnetik, Material Ferrimagnetik, Material Antiferromagnetik, Material Diamagnetik, Temperatur Curie, Néel Temperature, Domain Magnetik (Weiss domains), Kurva magnetisasi dan hysterisis loop, Rugi-rugi magnetik, Magnet Lunak dan Magnet Keras, Magnetostriksi | | | | | | | |
| **Pustaka** | | **Utama:** |  | | | | | | |
| 1. Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002 2. K. M. Gupta, Nishu Gupta, “Advanced Electrical and Electronics Material” , Wiley, 2015 | | | | | | | |
| **Pendukung:** |  | | | | | | |
| 1. Indulkar, C.S. and Thiruvengadam, S., “An Introduction to Electrical Engineering Materials”, S. Chand & Company, New Delhi, 1977 2. Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980 3. Martinez-Vega, Juan, “Dielectric Materials for Electrical Engineering”,. Wiley, 2010 | | | | | | | |
| **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 memahami prinsip material berdasar fisik material, klasifikasi material berdasar sifat listrik dan properti (sifat) dari material teknik | 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:**  Material Teknik  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 2 | Mahasiswa memahami model atom (model atom Dalton, model atom Thomson, model atom Rutherford, model atom Bohr, model mekanika kuantum) | 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:**  Model atom (model atom Dalton, model atom Thomson, model atom Rutherford, model atom Bohr, model wave-mechanical mekanika kuantum)  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 3 | Mahasiswa memahami bentuk orbital, konfigurasi elektro, ikatan primer (ikatan kimia, ikatan ionik, ikatan kovalen, ikatan logam), ikatan sekunder | 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:**  Bentuk orbital, konfigurasi elektro, ikatan primer (ikatan kimia, ikatan ionik, ikatan kovalen, ikatan logam), ikatan sekunder  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 4 | Mahasiswa memahami struktur kristal logam (BCC, FCC, HCP), atomic radius,atomic packing factor,lacctice system, pita energi (pita konduksi, pita Valensi, pita bagian dalam atom), Energy Gap, Fermy Energy | 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:**  Struktur kristal logam (BCC, FCC, HCP), atomic radius,atomic packing factor,lacctice system, pita energi (pita konduksi, pita Valensi, pita bagian dalam atom), Energy Gap, Fermy Energy  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 5 | Mahasiswa memahami struktur material konduktor dan sifat-sifat material konduktor. | 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:**  Material konduktor, sifat material konduktor (resistansi, induktansi, kapasitansi), faktor-faktor yang mempengaruhi resistivitas konduktor (temperatur, faktor campuran material atau alloying, mechanical stress, age hardening)  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 6 | Mahasiswa memahami fenomena efek kulit; non linear conductor, efek Seebeck dan Thermocouple, jenis-jenis Nickel-alloy thermocouples, jenis-jenis Platinum/rhodium-alloy thermocouples, Efek Hall dan 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:**  Efek kulit; non linear conductor, efek Seebeck dan Thermocouple, jenis-jenis Nickel-alloy thermocouples, jenis-jenis Platinum/rhodium-alloy thermocouples, Efek Hall  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 8% |
| 7 | Mahasiswa memahami prinsip potensial kontak, Thermistor dan Resistance Temperature Detector (RTD), PTC, NTC, konstruksi RTD, Superkonduktivitas, beberapa material konduktor dan 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:**  Potensial Kontak, Thermistor dan Resistance Temperature Detector (RTD), PTC, NTC, konstruksi RTD, Superkonduktivitas; Beberapa material konduktor  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 8 | UJIAN TENGAH SEMESTER |  |  |  |  |  |  |
| 9 | Mahasiswa memahami prinsip material semikonduktor, semikonduktor Intrinsik, konduktivitas pada semikonduktor intrinsik, semikonduktor ekstrinsik, semikonduktor tipe N, semikonduktor tipe P, pengaruh cahaya / radiasi pada semikonduktor, pengaruh temperatur pada semikonduktor dan Luminescence | 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:**  Material semikonduktor, semikonduktor Intrinsik, konduktivitas pada semikonduktor intrinsik, semikonduktor ekstrinsik, semikonduktor tipe N, semikonduktor tipe P, pengaruh cahaya / radiasi pada semikonduktor, pengaruh temperatur pada semikonduktor, Luminescence  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 8% |
| 10 | Mahasiswa memahami prinsip P-N Junction Dioda, forward biasing, reverse biasing (Zener Diode); karakteristik Volt-Amper (V/I) dari dioda, Schottcky Diode, Photo Diode, Solar Cell (photo Voltaic), transistor dan 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:**  P-N Junction Dioda, forward biasing, reverse biasing (Zener Diode); karakteristik Volt-Amper (V/I) dari dioda, Schottcky Diode, Photo Diode, Solar Cell (photo Voltaic), transistor  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 11 | Mahasiswa memahami prinsip material dielektrik/isolasi, polarisasi, polarisasi elektronik, polarisasi ionik, polarisasi orientasi, polarisasi interfasial dan 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:**  Material dielektrik/isolasi, polarisasi, polarisasi elektronik, polarisasi ionik, polarisasi orientasi, polarisasi interfasial  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 12 | Mahasiswa memahami teori dan prinsip rugi-rugi dielektrik, konstanta rugi-rugi dielektrik (𝐭𝐚𝐧 𝜹), arus bocor (leakage current), resistansi isolasi kabel, kekuatan dielektrik dan tegangan tembus, beberapa fenomena lain bahan isolasi; teori tembus listrik dielektrik gas (Townsend); teori tembus listrik dielektrik padat ( tembus listrik intrinsik, tembus listrik elektrotermal, tembus listrik elektromekanik) dan 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:**  Rugi-rugi dielektrik, konstanta rugi-rugi dielektrik (𝐭𝐚𝐧 𝜹), arus bocor (leakage current), resistansi isolasi kabel, kekuatan dielektrik dan tegangan tembus, beberapa fenomena lain bahan isolasi; teori tembus listrik dielektrik gas (Townsend); teori tembus listrik dielektrik padat ( tembus listrik intrinsik, tembus listrik elektrotermal, tembus listrik elektromekanik)  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 13 | Mahasiswa memahami prinsip teori tembus dielektrik cair (teori breakdown Kolloidal, teori breakdown Bubble (gelembung gas), Piezeoelektrisitas, efek Pyroelektrik, material ferroelektrik, photoresistor, klasifikasi material isolasi berdasarkan panas, contoh-contoh material dielektrik/isolasi dan 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 tembus dielektrik cair (teori breakdown Kolloidal, teori breakdown Bubble (gelembung gas), Piezeoelektrisitas, efek Pyroelektrik, material ferroelektrik, photoresistor, klasifikasi material isolasi berdasarkan panas, contoh-contoh material dielektrik/isolasi  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 14 | Mahasiswa memahami teori dan prinsip material magnetik, dipol magnetik, magnetisasi, klasifikasi material magnetik, material ferromagnetik, material paramagnetik, material ferrimagnetik, material antiferromagnetik, material diamagnetik dan 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:**  Material magnetik, dipol magnetik, magnetisasi, klasifikasi material magnetik, material ferromagnetik, material paramagnetik, material ferrimagnetik, material antiferromagnetik, material diamagnetik  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 15 | Mahasiswa memahami Temperatur Curie, Néel Temperature, Domain Magnetik (Weiss domains), kurva magnetisasi dan hysterisis loop, rugi-rugi magnetik, magnet lunak dan magnet keras, magnetostriksi dan 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:**  Temperatur Curie, Néel Temperature, Domain Magnetik (Weiss domains), kurva magnetisasi dan hysterisis loop, rugi-rugi magnetik, magnet lunak dan magnet keras, magnetostriksi  **Referensi:**   1. **Rajput, R.K., “Electrical Engineering Materials”, Laxmi Publications (P) LTD, New Delhi, 2002** 2. **Gupta, P.V., “A Course in Electrical Engineering Materials”, Dhanpat Rai & Sons, New Delhi, 1980** | 7% |
| 16 | UJIAN AKHIR SEMESTER |  |  |  |  |  |  |
|  | Total | | | | | | **100** |