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***	:	Energi Baru dan Terbarukan / *Renewable energy*
2	**Kode Mata Kuliah / *Course Code***	:	EE234714
3	**Kredit / *Credits***	:	3 SKS
4	**Semester / *Semester***	:	0

Deskripsi Mata Kuliah / *Course Description*

Mata kuliah ini memberikan gambaran tentang kondisi energi global dan peran energi baru dan terbarukan (EBT) sebagai sumber energi alternatif selain fossil fuel. Potensi , prinsip konversi dan karakteristik sumber EBT, terutama photovoltaic, tenaga angin, tenaga air dijelaskan melalui pemodelan matematis sederhana. Komponen-komponen penyusun sistem pembangkitan berbasis EBT dikenalkan dalam topologi stand-alone, grid-connected, dan hybrid. Topologi ini dibahas dengan analisis kesetimbangan energi sederhana disertai dengan contoh praktis. Pada mata kuliah ini juga diberikan analisis ekonomi sederhana seperti Simple Payback Period, IRR, dan NPV untuk menghitung investasi sistem pembangkitan berbasis EBT. / *This course provides an overview of the global energy situation and the role of renewable energy sources (RE) as an alternative energy source to fossil fuels. It explains the potential, conversion principles, and characteristics of RE sources, especially photovoltaic, wind, and hydropower, through simple mathematical modeling. The components of RE-based generation systems are introduced in stand-alone, grid-connected, and hybrid topologies. These topologies are discussed with simple energy balance analyses accompanied by practical examples. The course also includes a basic economic analysis, such as Simple Payback Period, IRR, and NPV, to calculate the investment in RE generation systems.*

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 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.*
Capaian Pembelajaran Mata Kuliah / *Course Learning Outcomes*	
1. Mampu menjelaskan secara umum kondisi energi global dan energi listrik secara khusus */ Able to provide a general overview of global energy conditions, with a specific focus on electrical energy.* *2.* Mampu menjelaskan prinsip konversi cahaya matahari menjadi listrik menggunakan sel surya / *Able to explain the principles of converting sunlight into electricity using solar cells.* 3. Mampu membuat karakteristik sel surya melalui model rangkaian ekivalen dan pengukuran / *Able to create the characteristics of solar cells through equivalent circuit models and measurements.* 4. Mampu menjelaskan prinsip konversi energi potensial air menjadi listrik menggunakan turbin air / *Able to explain the principles of converting the potential energy of water into electricity using water turbines.* 5. Mampu menghitung potensi daya listrik yang dihasilkan oleh sistem pembangkit tenaga air skala kecil / *Able to calculate the potential electrical power generated by small-scale hydroelectric power systems.* *6.* Mampu merancang sistem stand-alone pembangkit listrik skala kecil berbasis EBT dan menghitung rating komponen penyusun sistem termasuk penyimpan energi */ Able to design small-scale standalone renewable energy-based power generation systems and calculate the component ratings, including energy storage.*	

7. Mampu menghitung aspek ekonomis dari sistem EBT / *Able to calculate the economic aspects of renewable energy-based systems.*

Pokok Bahasan / *Contents*

1. Energi dunia dan peran EBT / *Global Energy and the Role of Renewable Energy Sources*
2. Spektrum cahaya matahari, semikonduktor sebagai sel surya, jenis dan teknologi sel surya / *Solar Spectrum, Semiconductors as Solar Cells, Types and Technologies of Solar Cells*
3. Single diode model untuk sel surya / *Single Diode Model for Solar Cells*
4. Energi potensial air dan prinsip konversinya / *Hydropower Potential and Its Conversion Principles*
5. Pembangkit listrik tenaga air skala kecil / *Small-Scale Hydropower Generation*
6. Energi potensial angin dan konversinya / *Wind Energy Potential and Its Conversion*
7. Pemodelan turbin angin / *Wind Turbine Modeling*
8. Sistem pembangkitan skala kecil berbasis EBT dan penyimpan energi listrik / *Small-Scale Renewable Energy-Based Generation Systems and Electric Energy Storage*
9. Analisis biaya, Simple Payback Period, IRR, dan NPV pembangkitan berbasis EBT / *Cost Analysis, Simple Payback Period, IRR (Internal Rate of Return), and NPV (Net Present Value) for Renewable Energy-Based Generation*

Prasyarat / *Pre-requisite*

Elektronika Daya / *Power Electronics*

Pustaka / *Reference*

1. Gilbert M. Masters , “Renewable and Efficient Electric Power Systems”, 2004 by John Wiley & Sons.
2. Thomas Ackermann, “Wind Power in Power Systems”, 2005 John Wiley & Sons
3. Mukund R. Patel, Wind and Solar Power Systems - Design, Analysis, and Operation”, 2006 by Taylor & Francis Group