PROGRAM SARJANA *(BACHELOR)*

Buku Pedoman Mata Kuliah *(Module Handbook)*

Departemen Teknik Elektro
Fakultas Teknologi Elektro dan Informatika Cerdas
Institut Teknologi Sepuluh Nopember

Electrical Engineering Department
Faculty of Intelligent Electrical and Informatics Technology

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I Capaian Pembelajaran Lulusan *(Program Learning Outcomes)*

Capaian Pembelajaran Lulusan (CPL) ***Program Learning Outcomes (PLO)***	
1	Mampu menerapkan ilmu pengetahuan alam dan matematika pada bidang teknik elektro (CPL-01) *Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem (PLO-1)*
2	Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan (CPL-02) *Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions (PLO-2)*
3	Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi (CPL-03) *Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects (PLO-3)*
4	Mampu bekerja secara efektif dalam kelompok yang beranggotakan lintas disiplin dan budaya dengan menunjukkan sifat kepemimpinan, dan mampu mendefinisikan tujuan, rencana kerja, dan capaian (CPL-04) *Capable to work effectively in groups of members across disciplines and cultures by showing leadership traits, and being able to define goals, work plans, and achievements(PLO-4)*

Capaian Pembelajaran Lulusan (CPL) ***Program Learning Outcomes (PLO)***	
5	Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro (CPL-05) *Capable to identify, formulate and solve problems in the field of electrical engineering (PLO-5)*
6	Mampu mematuhi hukum dan perataturan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial (CPL-06) *Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context* *(PLO-6)*
7	Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan (CPL-07) *Capable to communicate effectively both in written and oral form (PLO-7)*
8	Mampu menerapkan prinsip-prinsip kewirausahaan berbasis teknologi dan menjalin jejaring baik tingkat nasional dan internasional (CPL-08) *Capable to apply the principles of technology-based entrepreneurship and establish networks both at national and international levels (PLO-8)*
9	Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat (CPL-09) *Capable to learn independently to foster lifelong learning abilities (PLO-9)*
10	Mampu mengetahui dan menyikapi perkembangan terkini dibidang ilmu pengetahuan dan teknologi dengan mengedepankan nilai-nilai universal (CPL-10) *Capable to know and respond to the latest developments in science and technology by promoting universal values (PLO-10)*

Capaian Pembelajaran Lulusan (CPL) ***Program Learning Outcomes (PLO)***	
11	Mampu menerapkan metode, ICT, dan perangkat modern dalam penyelesaian permasalahan dibidang teknik elektro (CPL-11) *Capable to apply methods, ICT, and modern devices in solving problems in the field of electrical engineering (PLO-11)*
12	Mampu menunjukkan sikap religius, nasionalis, dan saling menghormati (CPL-12) *Capable to show religious, nationalist, and mutual respect characters (PLO-12)*

II Matriks CPL - Mata Kuliah (*PLO Matrix - Courses*)

1. Mata Kuliah Dasar Teknik Elektro

(Common Electrical Engineering Courses)

CPL	Aljabar Linier dan Struktur Diskrit	Dasar Pemrograman	Dasar Sistem dan Jaringan Telekomunikasi (Pengayaan)	Dasar Sistem Pengaturan (Pengayaan)	Dasar Sistem Tenaga Listrik (Pengayaan)	Internship	Kerja Praktik	Lab. Dasar Listrik dan Sistem Telekomunikasi	Lab. Elektronika, Dasar Sistem Tenaga dan Sistem Pengaturan	Medan Elektromagnetik	Metode Numerik	Pengantar Teknologi Elektro	Pengolahan Sinyal Digital	Persamaan Differensial Biasa dan Parsial	Pra Tugas Akhir	Probabilitas, Statistik, dan Proses Stokastik	Rangkaian Analog	Rangkaian Elektronika (Pengayaan)	Rangkaian Listrik	Rangkaian Listrik Lanjut	Sinyal dan Sistem	Sistem Digital dan Mikroprosesor	Topik Khusus	Tugas Akhir	**TOTAL**
CPL-01	1			1	1					1	1		1	1		1			1	1	1				11
CPL-02								1	1															1	3
CPL-03													1				1	1				1		1	5
CPL-04		1										1													2
CPL-05			1	1	1													1					1	1	6
CPL-06																									0
CPL-07								1	1			1											1		4
CPL-08																									0
CPL-09		1									1			1				1	1	1		1			7
CPL-10			1	1	1					1			1				1						1		7
CPL-11		1									1					1	1				1	1			6
CPL-12								1	1			1													3
	1	3	2	3	3	0	0	3	3	2	3	3	3	2	0	2	3	3	2	2	2	3	3	3	

PLO	*Linear Algebra and Discrete Structures*	*Basic Programming*	*Introduction to Telecommunication Systems and Networks (Enrichment)*	*Introduction to Control Systems (Enrichment)*	*Introduction to Power System (Enrichment)*	*Internship*	*Practical Work*	*Basic Laboratory of Electricity and Telecommunication Systems*	*Electrical Engineering Laboratory 2*	*Electromagnetic Fields*	*Numerical Methods*	*Introduction to Electrical Technology*	*Digital Signal Processing*	*Partial and Ordinary Differential Equations*	*Pre Final Project*	*Probability, Statistics, and Stochastic Processes*	*Analog Circuits*	*Electronic Circuits (Enrichment)*	*Electric Circuits*	*Advanced Electric Circuits*	*Signals dan Systems*	*Digital and Microprocessor Systems*	*Special Topic*	*Final Project*	***TOTAL***
PLO-01	1			1	1					1	1		1	1		1			1	1	1				11
PLO-02								1	1															1	3
PLO-03													1				1	1				1		1	5
PLO-04		1										1													2
PLO-05			1	1	1													1					1	1	6
PLO-06																									0
PLO-07								1	1			1											1		4
PLO-08																									0
PLO-09		1									1			1				1	1	1		1			7
PLO-10			1	1	1					1			1				1						1		7
PLO-11		1									1					1	1				1	1			6
PLO-12								1	1			1													3
	1	3	2	3	3	0	0	3	3	2	3	3	3	2	0	2	3	3	2	2	2	3	3	3	

2. Mata Kuliah Bidang Keahlian *(Specialization Field Courses)*

	Elektronika										Telekomunikasi Multimedia										Teknik Sistem Pengaturan										Teknik Sistem Tenaga									
CPL	Divais Semikonduktor dan Rangkaian Terintegrasi	Sistem Elektronika Tertanam	Sensor dan Akuator	Perancangan Sistem Elektronika Analog	Akuisisi Data dan Pengolahan Sinyal	Perancangan Komponen Terprogram	Elektronika Industri dan Robotika	Lab. Sistem Elektronika Terpadu	**Total Wajib Elka**		Sistem Komunikasi 1	Transmisi Gelombang Elektromagnetik dan Antena	Jaringan dan Rekayasa Trafik	Sistem Komunikasi 2	Propagasi Gelombang	Elektronika Telekomunikasi	Jaringan Komunikasi Nirkabel	Lab. Telekomunikasi	**Total Wajib TMM**		Analisis dan Desain Sistem Pengaturan	Otomasi Sistem	Teknik Optimisasi	Instrumentasi Sistem Pengaturan	Sistem Pengaturan Digital	Komputasi Sistem Linier	Lab. Pengaturan Digital dan Otomasi	Perancangan dan Integrasi Sistem	**Total Wajib TSP**		Analisis Sistem Tenaga	Mesin Listrik	Teknik Tegangan Tinggi	Elektronika Daya	Pembangkitan Tenaga Listrik	Transmisi dan Peralatan Tegangan Tinggi	Distribusi Tenaga Listrik	Lab. Sistem Tenaga	**Total Wajib TST**
CPL-01			1						1			1			1				2									3		1	1	1			1	1		5
CPL-02				1	1			1	3							1		1	2							1		1								1	1
CPL-03	1	1		1	1	1	1		6			1	1		1	1	1		5		1	1					1	3					1	1				2
CPL-04									0										0		1							1										0
CPL-05							1	1	2		1			1	1				4		1	1	1	1	1	1		1	7			1	1	1	1	1	1		6
CPL-06								1	1		1				1				2					1					1					1					1
CPL-07									1										1								1		1								1		1
CPL-08									0										0										0										0
CPL-09					1	1			2										0										0										0
CPL-10	1	1	1						3			1	1			1	1	1	5			1					1	2		1									1
CPL-11	1	1	1	1					4		1			1					2				1	1	1	1		4		1	1	1	1		1	1		6
CPL-12								1	1									1	1							1		1								1	1	1
	3	3	3	3	3	3	3	3			3	3	3	3	3	3	3	3			3	3	3	3	3	3	3				3	3	3	3	3	3	3	3	

	Electronics										*Multimedia Telecommunication*										*Control System Engineering*										*Power System Engineering*									
PLO	*Semiconductor Devices and Integrated Circuits*	*Embedded Electronic System*	*Sensors and Actuators*	*Design of Analog Electronic Systems*	*Acquisition and Signal Processing*	*Design Using Programmable Device*	*Industrial Electronics and Robotics*	*Integrated Electronic Systems Lab*	***Total of Electronics Compulsory***		*Communication Systems 1*	*Electromagnetic Wave Transmission and Antennas*	*Networks and Traffic Engineering*	*Communication Systems 2*	*Wave Propagation*	*Communication Electronics*	*Wireless Communication Networks*	*Telecommunication Laboratory*	***Total of Multimedia Telecom. Compulsory***		*Contol System Analysis and Design*	*System Automation*	*Optimization Techniques*	*Control System Instrumentation*	*Digital Control Systems*	*Linear System Computation*	*Digital Control and Automation Laboratory*	*System Design and Integration*	***Total of Control System Eng. Compulsory***		*Power System Analysis*	*Electric Machines*	*High Voltage Engineering*	*Power Electronics*	*Electric Power Generation*	*Transmission and High-Voltage Equipment*	*Electric Power Distribution*	*Power System Laboratory*	***Total of Power System Eng. Compulsory***
PLO-01			1						1			1			1				2				1		1		3		1	1	1			1	1		5
PLO-02				1	1			1	3							1		1	2							1		1								1	1
PLO-03	1	1		1	1	1	1		6			1	1		1	1	1		5		1	1					1	3					1	1				2
PLO-04									0										0		1							1										0
PLO-05							1	1	2		1			1	1				4		1	1	1	1	1	1		1	7			1	1	1	1	1	1		6
PLO-06								1	1		1				1				2					1					1					1					1
PLO-07									1										1								1		1								1		1
PLO-08									0										0										0										0
PLO-09					1	1			2										0										0										0
PLO-10	1	1	1						3			1	1			1	1	1	5			1					1	2		1									1
PLO-11	1	1	1	1					4		1			1					2				1	1	1	1		4		1	1	1	1		1	1		6
PLO-12								1	1									1	1							1		1								1	1	1
	3	3	3	3	3	3	3	3			3	3	3	3	3	3	3	3			3	3	3	3	3	3	3				3	3	3	3	3	3	3	3	

3. Mata Kuliah Pilihan *(Elective Courses)*

	Elektronika								Telekomunikasi Multimedia												Teknik Sistem Pengaturan											Teknik Sistem Tenaga										
CPL	Dasar Sistem Elektronika Cerdas	Divais Optoelektronika	Instrumentasi Elektronika	Penginderaan Visual Elektronika	Sistem Kontrol Elektronika	Sistem Robot Otonom	**Total Pilihan Elka**		Jaringan Satelit dan Pengindraan Jauh	Jaringan Sensor Nirkabel dan IoT	Layanan dalam Jaringan	Pengolahan Sinyal Multimedia	Rekayasa Internet dan Web	Rekayasa Sistem dan Manajemen Proyek Telekomunikasi	Sekuriti dan Kriptografi	Sistem Broadcast	Sistem Gelombang Mikro, Radar dan Navigasi	Standard dan Keandalan Sistem Komunikasi	**Total Pilihan TKMM**		Analisis Jaringan	Pengaturan Penggerak Elektrik	Pengolahan Sinyal Pengaturan	Robotika	Sistem Multi Agen	Sistem Pengaturan Adaptif	Sistem Pengaturan Cerdas	Sistem Pengaturan Optimal	Sistem Pengaturan Proses	Sistem Pengaturan Tertanam	**Total Pilihan TSP**		Desain dan Instalasi Tenaga Listrik	Dinamika dan Stabilitas Sistem Tenaga Listrik	Energi Baru dan Terbarukan	Fenomena Transien Tegangan Tinggi	Kecerdasan Buatan dalam Sistem Tenaga Listrik	Kualitas Daya Listrik	Manajemen Proyek dan Keselamatan Kerja	Operasi Optimum Sistem Tenaga Listrik	Pemeliharaan Peralatan Listrik	Pengaman Sistem Tenaga Listrik	Penggunaan dan Pengemudian Motor Listrik	Perencanaan Sistem Tenaga Listrik	**Pilihan TST**
CPL-01							0								1				1		1									1									2
CPL-02							0												0											0									1
CPL-03	1	1	1	1	1		5		1	1		1	1	1			1	1	7		1	1	1	1						4	1		1					1	1	1	5
CPL-04							0												0											0										0
CPL-05	1				1	1	3		1	1	1			1		1			5			1	1	1	1	1	1	1		8	1	1	1		1	1		1		1	1	8
CPL-06			1			1	2							1	1	1	1	1	5				1							1	1			1		1		1			5
CPL-07							0												0											0				1		1					3
CPL-08							0												0											0											0
CPL-09							0												0											0											0
CPL-10		1		1		1	3		1	1	1	1				1		1	6		1	1	1	1						4				1	1					1	3
CPL-11	1	1	1	1	1		5				1		1		1				3					1	1	1	1	1	1	6		1	1		1	1		1		1	1	7
CPL-12							0							1					1											0						1					1
	3	3	3	3	3	3			3	3	3	3	3	3	3	3	3	3			3	3	3	3	3	3	3	3	3			3	3	3	3	3	3	3	3	3	

	Elektronika								Telekomunikasi Multimedia												Teknik Sistem Pengaturan											Teknik Sistem Tenaga										
CPL	*Basic Intelligent Electronic System*	*Optoelectronic devices*	*Electronic Instrumentation*	*Machine Vision*	*Electronic Control System*	*Autonomous Robot System*	***Total of Electronics Elective Course***		*Satellite Network and Remote Sensing*	*Wireless Sensor Network and Internet of Things (IoT*	*Services over Networks*	*Multimedia Signal Processing*	*Internet Engineering and Web*	*Telecommunication System Engineering and Project*	*Security and Cryptography*	*Broadcasting System*	*Microwave, Radar and Navigation Systems*	*Communication Systems Standard and Reliability*	**Total of Multimedia Telecom. Course**		*Network Analysis*	*Control of Electric Drives*	*Signal Processing for Control*	*Robotics*	*Multi-agent Systems*	*Adaptive Control Systems*	*Intelligent Control Systems*	*Optimal Control Systems*	*Process Control Systems*	*Embedded Regulatory System*	**Total of ControlSystem Eng. Elective Course**		*Electrical Design and Installation*	*Dynamics and Stability of Power System*	*Renewable Energy*	*High Voltage Transient Phenomena*	*Artificial Intelligence in Power System*	*Power Quality*	*Project Management and Occupational Safety*	*Optimum Operation of Power System*	*Electrical Power Equipment Maintenance*	*Power System Protection*	*Electric Motor Drive and Application*	*Power System Planning*	**Total of Power System Eng. Elective Course**
CPL-01							0					1			1		1	3	1									1	7			1										2
CPL-02							0												0										0												1
CPL-03	1	1	1	1	1		5		1	1		1	1	1			1	1	7	1	1	1	1						4	1			1								5
CPL-04							0												0										0												0
CPL-05	1					1	1	3	1	1	1		1			1			5			1	1	1	1	1	1	1	8	1	1	1		1	1		1		1	1	1	8
CPL-06			1				1	2						1	1	1	1	1	5					1					1	1					1		1			1	5
CPL-07							0												0										0					1							3
CPL-08							0												0										0												0
CPL-09							0												0										0												0
CPL-10		1		1		1	3		1	1	1	1				1		1	6	1	1	1	1						4				1	1					1	3
CPL-11	1	1	1	1	1		5				1		1		1				3					1	1	1	1	1	6		1	1		1	1		1		1	1	7
CPL-12							0							1					1										0						1					1
	3	3	3	3	3	3			3	3	3	3	3	3	3	3	3	3			3	3	3	3	3	3	3	3	3			3	3	3	3	3	2	3	3	3	

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III Struktur Kurikulum 2018 *(2018 Curriculum Structure)*

No. ***No.***	**Kode MK** ***Course Code***	**Nama Mata Kuliah (MK)** ***Course Name***	**SKS** ***Credits***
SEMESTER I			
1	KM184101	Matematika I *Mathematics I*	3
2	SF184101	Fisika I *Physics I*	4
3	UG184911	Pancasila *Pancasila*	2
4	UG184914	Bahasa Inggris *English*	2
5	UG18490X	Agama *Religion*	2
6	EW184001	Pengantar Teknologi Elektro *Introduction to Electrical Technology*	2
7	EW184002	Dasar Pemrograman *Basic Programming*	3
		Jumlah SKS ***Number of Credits***	**18**
SEMESTER II			
1	KM184201	Matematika II *Mathematics II*	3
2	SF184202	Fisika II *Physics II*	3
3	SK184101	Kimia *Chemistry*	3
4	UG184913	Kewarganegaraan *Citizenship*	2
5	UG184912	Bahasa Indonesia *Indonesian*	2
6	EW184003	Rangkaian Listrik *Electric Circuits*	2
7	EE184201	Aljabar Linier dan Struktur Diskrit *Linier Algebra and Discrete Structures*	3
		Jumlah SKS	**18**

		Number of Credits	
SEMESTER III			
1	EE184301	Rangkaian Listrik Lanjut *Advanced Electric Circuits*	3
2	EE184302*	Dasar Sistem dan Jaringan Telekomunikasi *Introduction to Telecommunication Systems and Networks*	3
3	EE184303	Medan Elektromagnetik *Electromagnetic Fields*	4
4	EE184304	Persamaan Differensial Biasa dan Parsial *Partial and Ordinary Differential Equations*	3
5	EE184305	Sinyal dan Sistem *Signals dan Systems*	3
6	EE184306*	Rangkaian Elektronika *Electronic Circuits*	3
		Jumlah SKS ***Number of Credits***	**19**
SEMESTER IV			
1	EE184401	Sistem Digital dan Mikroprosesor *Digital and Microprocessor Systems*	4
2	EE184402*	Dasar Sistem Tenaga Listrik *Introduction to Power System*	3
3	EE184403	Pengolahan Sinyal Digital *Digital Signal Processing*	3
4	EE184404*	Dasar Sistem Pengaturan *Introduction to Control Systems*	3
5	EE184405	Probabilitas, Statistik dan Proses Stokastik *Probability, Statistics, and Stochastic Processes*	4
6	EE184406	Lab. Rangk. Listrik dan Dasar Sist. dan Jar. Tel. *Basic Laboratory of Electricity and Telecommunication Systems*	3
		Jumlah SKS ***Number of Credits***	**20**
SEMESTER V			
1	EE184005	Metode Numerik *Numerical Methods*	3
2	EE184501	Rangkaian Analog *Analog Circuits*	3

3	EE184502	Lab. Elka, DST.Listrik dan Sis.Pengaturan *Electrical Engineering Laboratory 2*	3
		MK Bidang Keahlian *Specialization Field Courses*	11
		Jumlah SKS ***Number of Credits***	**20**
SEMESTER VI			
1	UG184915	Teknopreneur *Technopreneurship*	2
2	EE184601	Kerja Praktik *Practical Work*	2
3		MK Pengayaan *Enrichment Courses*	3
		MK Bidang Keahlian *Specialization Field Courses*	12
		Jumlah SKS ***Number of Credits***	**19**
SEMESTER VII			
1	UG184916	Wawasan dan Aplikasi Teknologi *Technology Insights and Applications*	3
2	EE184701	Pra Tugas Akhir *Pre-Final Project*	3
		MK Bidang Keahlian *Specialization Field Courses*	3
		MK Pilihan *Elective Courses*	9
		Jumlah SKS ***Number of Credits***	**18**
SEMESTER VIII			
1	EE184801	Tugas Akhir *Final Project*	6
		MK Pilihan *Elective Courses*	6
		Jumlah SKS ***Number of Credits***	**10**

MATA KULIAH BIDANG KEAHLIAN: Teknik Sistem Tenaga
(SPECIALIZATION FIELD COURSES: Power System Engineering)

No. ***No.***	**Kode MK** ***Course Code***	**Nama Mata Kuliah (MK)** ***Course Name***	**SKS** ***Credits***
SEMESTER V			
1	EE184511	Analisis Sistem Tenaga *Power System Analysis*	4
2	EE184512	Mesin Listrik *Electric Machines*	4
3	EE184513	Teknik Tegangan Tinggi *High Voltage Engineering*	3
		Jumlah SKS ***Number of Credits***	**11**
SEMESTER VI			
1	EE184611	Elektronika Daya *Power Electronics*	3
2	EE184612	Pembangkitan Tenaga Listrik *Electric Power Generation*	3
3	EE184613	Transmisi dan Peralatan Tegangan Tinggi *Transmission and High-Voltage Equipment*	3
4	EE184614	Distribusi Tenaga Listrik *Electric Power Distribution*	3
		Jumlah SKS ***Number of Credits***	**12**
SEMESTER VII			
1	EE184711	Lab. Sistem Tenaga *Power System Laboratory*	3
		Jumlah SKS ***Number of Credits***	**3**

MATA KULIAH BIDANG KEAHLIAN: Teknik Sistem Pengaturan
(SPECIALIZATION FIELD COURSES: Control System Engineering)

No. ***No***	**Kode MK** ***Course Code***	**Nama Mata Kuliah (MK)** ***Course Name***	**SKS** ***Credits***
SEMESTER V			
1	EE184521	Analisis dan Desain Sistem Pengaturan *Contol System Analysis and Design*	4
2	EE184522	Otomasi Sistem *System Automation*	3
3	EE184523	Teknik Optimisasi *Optimization Techniques*	4
		Jumlah SKS ***Number of Credits***	**11**
SEMESTER VI			
1	EE184621	Instrumentasi Sistem Pengaturan *Control System Instrumentation*	3
2	EE184622	Sistem Pengaturan Digital *Digital Control Systems*	3
3	EE184623	Komputasi Sistem Linier *Linear System Computation*	3
		Jumlah SKS ***Number of Credits***	**9**
SEMESTER VII			
1	EE184721	Lab. Pengaturan Digital dan Otomasi *Digital Control and Automation Laboratory*	2
2	EE184722	Perancangan dan Integrasi Sistem *System Design and Integration*	4
		Jumlah SKS ***Number of Credits***	**6**

MATA KULIAH BIDANG KEAHLIAN: Telekomunikasi Multimedia
(MATA KULIAH BIDANG KEAHLIAN: Multimedia Telecommunications)

No. ***No***	**Kode MK** ***Course Code***	**Nama Mata Kuliah (MK)** ***Course Name***	**SKS** ***Credits***
SEMESTER V			
1	EE184531	Sistem Komunikasi I *Communication Systems 1*	3
2	EE184532	Transmisi Gelombang Elektromagnetik dan Antena *Electromagnetic Wave Transmission and Antennas*	4
3	EE184533	Jaringan dan Rekayasa Trafik *Networks and Traffic Engineering*	4
		Jumlah SKS ***Number of Credits***	**11**
SEMESTER VI			
1	EE184631	Sistem Komunikasi II *Communication Systems 2*	3
2	EE184632	Propagasi Gelombang *Wave Propagation*	3
3	EE184633	Elektronika Telekomunikasi *Communication Electronics*	3
4	EE184634	Jaringan Komunikasi Nirkabel *Wireless Communication Networks*	3
		Jumlah SKS ***Number of Credits***	**12**
SEMESTER VII			
1	EE184731	Lab.Telekomunikasi *Telecommunication Laboratory*	3
		Jumlah SKS ***Number of Credits***	**3**

MATA KULIAH BIDANG KEAHLIAN: Elektronika

(MATA KULIAH BIDANG KEAHLIAN: Electronic Engineering)

No. ***No***	**Kode MK** ***Course Code***	**Nama Mata Kuliah (MK)** ***Course Name***	**SKS** ***Credits***
SEMESTER V			
1	EE184541	Divais Semikonduktor dan Rangkaian Terintegrasi *Semiconductor Devices and Integrated Circuits*	4
2	EE184542	Sistem Elektronika Tertanam *Embedded Electronic System*	4
3	EE184543	Sensor dan Akuator *Sensors and Actuators*	3
		Jumlah SKS ***Number of Credits***	**11**
SEMESTER VI			
1	EE184641	Perancangan Sistem Elektronika Analog *Design of Analog Electronic Systems*	3
2	EE184642	Akuisisi Data dan Pengolahan Sinyal *Acquisition and Signal Processing*	3
3	EE184643	Perancangan Komponen Terprogram *Design Using Programmable Device*	3
4	EE184644	Elektronika Industri dan Robotika *Industrial Electronics and Robotics*	3
		Jumlah SKS ***Number of Credits***	**12**
SEMESTER VII			
1	EE184741	Lab. Sistem Elektronika Terpadu *Integrated Electronic Systems Lab.*	3
		Jumlah SKS ***Number of Credits***	**3**

MATA KULIAH PILIHAN *(ELECTIVE COURSES)*

No. *No*	Kode *Code*	Nama Mata Kuliah *Course Name*	Sks *Credits*
1	EE184710	Pengaman Sistem Tenaga Listrik* *Power System Protection **	2
2	EE184810	Desain dan Instalasi Tenaga Listrik* *Electrical Design and Installation **	4
3	EE184910	Operasi Optimum Sistem Tenaga Listrik *Optimum Operation of Power System*	3
4	EE184911	Fenomena Transien Tegangan Tinggi *High Voltage Transient Phenomena*	3
5	EE184912	Penggunaan dan Pengemudian Motor Listrik *Electric Motor Drive and Application*	3
6	EE184913	Dinamika dan Stabilitas Sistem Tenaga Listrik *Dynamics and Stability of Power System*	3
7	EE184914	Kecerdasan Buatan dalam Sistem Tenaga Listrik *Artificial Intelligence in Power System*	3
8	EE184915	Perencanaan Sistem Tenaga Listrik *Power System Planning*	3
9	EE184916	Kualitas Daya Listrik *Power Quality*	3
10	EE184917	Pemeliharaan Peralatan Listrik *Electrical Power Equipment Maintenance*	3
11	EE184918	Sistem Energi Baru dan Terbarukan *Renewable Energy*	3
12	EE184919	Manajemen Proyek dan Keselamatan Kerja *Project Management and Occupational Safety*	3
13	EE184920	Sistem Pengaturan Optimal *Optimal Control Systems*	3
14	EE184921	Sistem Pengaturan Adaptif *Adaptive Control Systems*	3
15	EE184922	Sistem Pengaturan Cerdas *Intelligent Control Systems*	3
16	EE184923	Pengolahan Sinyal Pengaturan *Signal Processing for Control*	3
17	EE184924	Analisis Jaringan *Network Analysis*	3

18	EE184925	Sistem Multi Agen *Multi-agent Systems*	3
19	EE184926	Sistem Pengaturan Proses *Process Control Systems*	3
20	EE184927	Pengaturan Penggerak Elektrik *Control of Electric Drives*	3
21	EE184928	Robotika *Robotics*	3
22	EE184929	Sistem Pengaturan Embedded *Embedded Regulatory System*	3
23	EE184930	Sekuriti dan Kriptografi *Security and Cryptography*	3
24	EE184931	Sistem Gelombang Mikro, Radar dan Navigasi *Microwave, Radar and Navigation Systems*	3
25	EE184932	Standard dan Keandalan *Communication Systems Standard and Reliability*	3
26	EE184933	Sistem Broadcast *Broadcasting System*	3
27	EE184934	Layanan Dalam Jaringan *Services over Networks*	3
28	EE184935	Rekayasa Sistem dan Man. Proyek Telekomunikasi *Telecommunication System Engineering and Project*	3
29	EE184936	Rekayasa Internet dan Web *Internet Engineering and Web*	3
30	EE184937	Pengolahan Sinyal Multimedia *Multimedia Signal Processing*	3
31	EE184938	Jaringan Sensor Nirkabel dan IoT *Wireless Sensor Network and Internet of Things (IoT)*	3
32	EE184939	Jaringan Satelit dan Pengindraan Jauh *Satellite Network and Remote Sensing*	3
33	EE184940	Dasar Sistem Elektronika Cerdas *Basic Intelligent Electronic System*	3
34	EE184941	Divais Optoelektronika *Optoelectronic devices*	3
35	EE184942	Sistem Kontrol Elektronika *Electronic Control System*	3
36	EE184943	Instrumentasi Elektronika *Electronic Instrumentation*	3

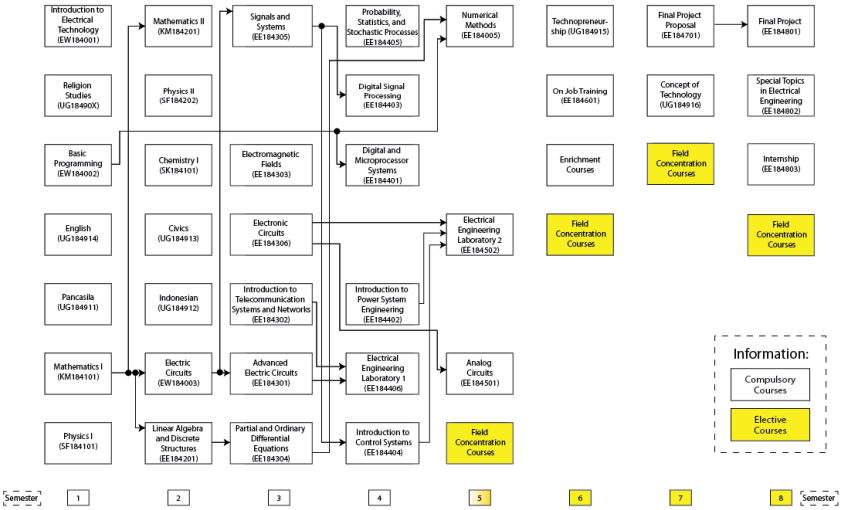
37	EE184944	Penginderaan Visual Elektronika *Machine Vision*	3
38	EE184945	Sistem Robot Otonom *Autonomous Robot System*	3
39	EE184802	Topik Khusus *Special Topic*	3
40	EE184803	Internship *Internship*	3

MATA KULIAH PENGAYAAN *(ENRICHMENT COURSES)*

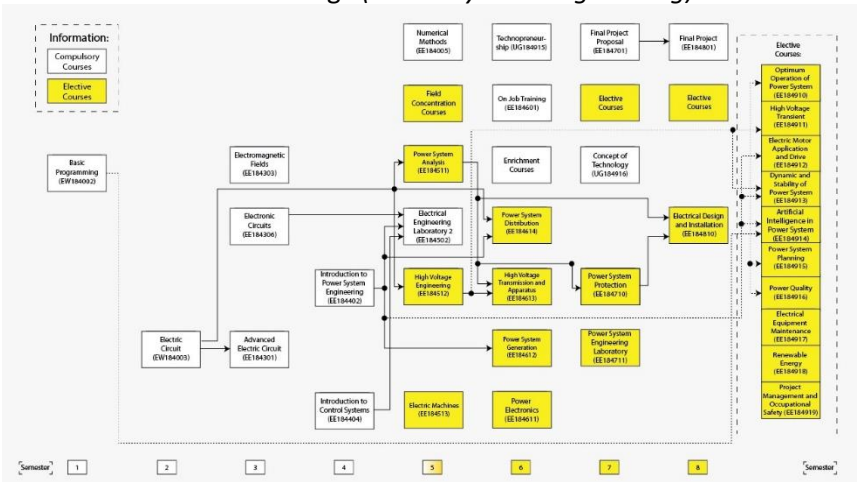
No. ***No.***	**Kode** ***Code***	**Nama Mata Kuliah** ***Course Name***	**SKS** ***Credits***
1			
2			
3			
4			
5			
6			
7			

IV Alur Pengambilan Mata Kuliah (*Course Flow*)

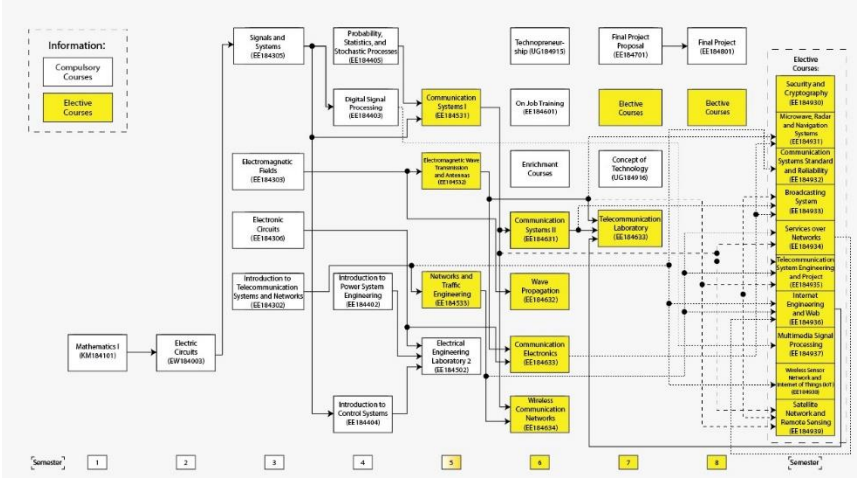
A. Mata Kuliah Dasar Elektro *(Common Electrical Engineering Courses)*



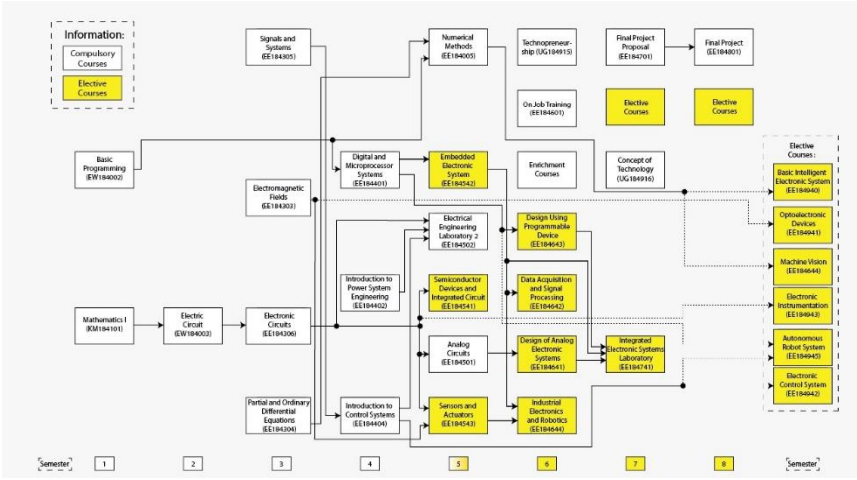
B. Teknik Sistem Tenaga *(Power System Engineering)*



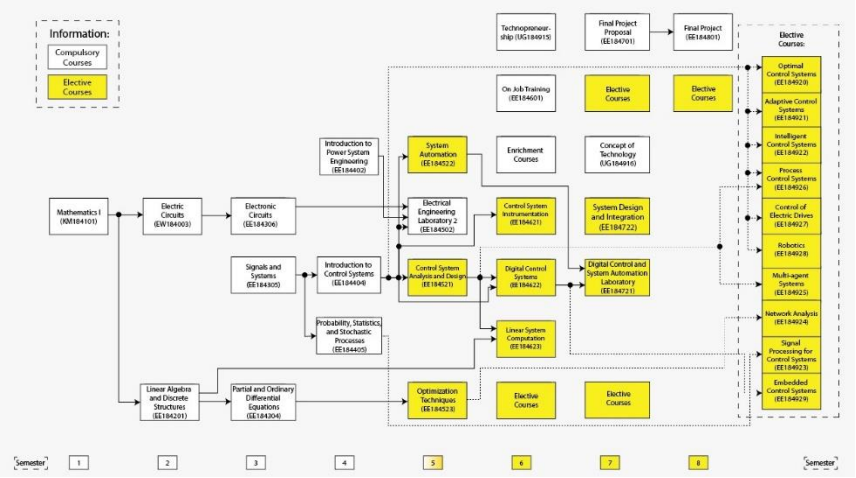
C. Telekomunikasi Multimedia (*Multimedia Telecommunications*)



D. Elektronika (*Electronics*)



E. Teknik Sistem Pengaturan *(Control System Engineering)*



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V SILABUS MATA KULIAH *(COURSES SYLLABUS)*

Mata Kuliah ***Course***	Nama MK *Name*	:	Pengantar Teknologi Elektro *Introduction to Electrical Technology*
	Kode MK *Code*	:	EW184001
	Semester *Semester*	:	I (Wajib) *I (Compulsory)*
	Kredit *Credits*	:	2 sks
	Kredit *Credits*	:	2 sks
	Kredit *Credits*	:	2 sks
	Beban Belajar *Workload*	:	Kuliah : 2 x 50 = 100 menit/minggu Latihan/tugas : 2 x 60 = 120 menit/minggu Belajar mandiri : 2 x 60 = 120 menit/minggu *Lectures : 2 x 50 = 100 min/week* *Exercises/Assignments : 2 x 60 = 120min/week* *Self learning : 2 x 60 = 120 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Tasripan, MT
	Pengajar *Lecturer*	:	Ir. Tasripan, MT Dr.Ir. Ari Santoso, DEA Devy Kuswidiastuti, ST, M.Sc Sri Rahayu, ST, M.Kom

			Dr. Ir. Endroyono, DEA Dr. Ir. Margo Pujiantara, MT Dr.Ir. Yoyon Kusnendar Suprapto, M.Sc Prof.Dr.Ir. Moch. Nuh, DEA M. Hilman Fatoni, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Pengantar Teknologi Elektro membahas dasar-dasar teknologi elektro yang meliputi materi pengantar ke teknik sistem tenaga, teknik sistem pengaturan, elektronika, teknik telekomunikasi, teknik komputer, dan teknik biomedik serta sejarah dan dampak teknologi elektro bagi peradaban, peran fisika dan matematika dalam teknologi elektro, dan pentingnya kreativitas dan integritas bagi sarjana teknologi elektro.

Introduction to Electrical Technology course discusses the basics of electrical technology which includes introductory material into power systems engineering, control systems engineering, electronics, telecommunications engineering, computer engineering, and biomedical engineering also the history and impact of electrical technology for civilization, the role of physics and mathematics in technology electrical engineering, and the importance of creativity and integrity for student in electrical technology.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-04) Mampu bekerja secara efektif dalam kelompok yang beranggotakan lintas disiplin dan budaya dengan menunjukkan sifat kepemimpinan, dan mampu mendefinisikan tujuan, rencana kerja, dan capaian

(PLO-4) Capable to work effectively in groups of members across disciplines and cultures by showing leadership traits, and being able to define goals, work plans, and achievements

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-7) Capable to communicate effectively both in written and oral form

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, saling menghormati.

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep, prinsip dan prosedur perancangan sistem tenaga listrik, sistem pengaturan, telekomunikasi multimedia, elektronika, teknik komputer, dan teknik biomedik.

(CLO-01) Mastering the concepts, principles and procedures of electric power system design, regulatory systems, multimedia telecommunications, electronics, computer engineering, and biomedical engineering.

(CPMK-02) Mampu memformulasikan permasalahan rekayasa pada sistem tenaga listrik, sistem pengaturan, telekomunikasi multimedia, elektronika, teknik komputer, dan teknik biomedik.

(CLO-02) Be able to formulate engineering problems in electric power systems, control systems, multimedia telecommunications, electronics, computer engineering, and biomedical engineering.

(CPMK-03) Mampu mendeskripsikan penyelesaian permasalahan rekayasa pada sistem tenaga listrik, sistem pengaturan, telekomunikasi multimedia, elektronika, teknik komputer, dan teknik biomedik.

(CLO-03) Be able to describe the resolution of engineering problems in electric power systems, control systems, multimedia telecommunications, electronics, computer engineering, and biomedical engineering.

(CPMK-04) Mampu mengambil keputusan secara tepat dalam konteks penyelesaian masalah di bidang keahliannya, berdasarkan hasil analisis informasi dan data.

(CLO-04) Able to make decisions appropriately in the context of problem solving in his field of expertise, based on the results of analysis of information and data.

(CPMK-05) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri

(CLO-05) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan

Main Subjects

1. Pengantar teknik sistem tenaga
   Introduction to power system techniques
2. Pengantar teknik sistem pengaturan
   Introduction to control system techniques
3. Pengantar elektronika
   Introduction to electronics
4. Pengantar teknik telekomunikasi

Introduction to telecommunications techniques

5. Pengantar teknik komputer
   Introduction to computer engineering
6. Pengantar teknik biomedika
   Introduction to biomedical techniques
7. Sejarah/timeline teknologi elektro (Volta, Ohm, Kelvin, Faraday, Biot Savart, Laplace, Ampere, Maxwell, dan seterusnya)
   History/timeline of electrical technology (Volta, Ohm, Kelvin, Faraday, Biot Savart, Laplace, Ampere, Maxwell, and so on)
8. Dasar fenomena listrik dan magnet (elektron, arus listrik, listrik magnet, batere, dst)
   Basic phenomena of electricity and magnetism (electrons, electric current, magnetic electricity, batteries, etc.)
9. Fisika dan matematika dalam teknologi elektro (fenomena fisika dari elektro, pemodelan matematika untuk sinyal dan sistem dalam teknologi elektro)
   Physics and mathematics in electrical technology (electro physical phenomena, mathematical modeling for signals and systems in electrical technology)
10. Dampak teknologi elektro terhadap perkembangan peradaban (transportasi, dsb)
    Impact of electrical technology on the development of civilization (transportation, etc.)
11. Kreativitas bagi sarjana teknologi elektro dalam menghadapi perkembangan teknologi (memiliki penguasaan dasar yang kuat)
    Creativity for graduates of electrical technology in the face of technological developments (having strong basic mastery)
12. Kode etik dan integritas bagi sarjana teknologi elektro (pengakuan terhadap hasil karya orang lain, upaya mandiri dalam menyelesaikan permasalahan, dst)
    Code of ethics and integrity for scholars of electrical technology (recognition of the work of others, independent efforts to solve problems, etc.)

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] Anthonie Meijers, Philosophy of Technology and Engineering Sciences, Elsevier, 2009.
[2] Clive Maxfield dkk, Electrical Engineering, Elsevier, 2008.
[3] Don Johnson, J. D. Wise, Fundamentals of Electrical Engineering, University Press of Florida, 2009.
[4] Charles Gross, Thaddeus Roppel, Fundamentals of Electrical Engineering, Taylor and Francis, 2012.
[5] Stan Gibilisco, Teach Yourself Electricity and Electronics, ed. 4, McGraw-Hil, 2006.

Prasyarat

Prerequisite(s)

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Mata Kuliah ***Course***	Nama MK *Name*	:	Dasar Pemrograman *Basic Programming*
	Kode MK *Code*	:	EW184002
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	I (Wajib) *I (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Fajar Budiman, ST, M.Eng
	Pengajar *Lecturer*	:	Eko Pramunanto, ST, MT Dr. Eko Mulyanto Yuniarno, ST, MT Dr.Ir. Yoyon Kusnendar Suprapto, M.Sc Fajar Budiman, ST, M.Eng M. Hilman Fatoni, ST, MT Atar Fuady Babgei, ST., M.Sc. Eko Pramunanto, ST, MT Dr. Eko Mulyanto Yuniarno, ST, MT Dr.Ir. Yoyon Kusnendar Suprapto, M.Sc Dr. Eng Mohammad Attamimi B. Eng. M. Eng
	Bahasa	:	Bahasa Indonesia dan Bahasa Inggris

	Language		*Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Pada mata kuliah ini, mahasiswa akan mempelajari pengetahuan dasar pemrograman, konsep algoritma, pemrograman tersetruktur, runtunan, pengulangan, pemilihan, fungsi, tipe data, konsep struktur dan file.

In this course, students will learn basic programming knowledge, algorithm concepts, structured programming, sequences, repetition, selection, functions, data types, structural concepts and files.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-04) Mampu bekerja secara efektif dalam kelompok yang beranggotakan lintas disiplin dan budaya dengan menunjukkan sifat kepemimpinan, dan mampu mendefinisikan tujuan, rencana kerja, dan capaian

(PLO-4) Capable to work effectively in groups of members across disciplines and cultures by showing leadership traits, and being able to define goals, work plans, and achievements

(CPL-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-9) Capable to learn independently to foster lifelong learning abilities

(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) Mahasiswa menguasai konsep algoritma pemprograman komputer yang meliputi runtunan, perulangan dan pemilihan, konsep fungsi, struktur/ record dan file.

(CLO-01) Students is able to mastering the concept of computer programming algorithms which include collections, repetition and selection, concepts of functions, structures / records and files.

(CPMK-02) Mahasiswa mampu membuat program aplikasi komputer menggunakan bahasa pemprograman C.

(CLO-02) Students are able to make computer application programs using the C programming language.

(CPMK-03) Mahasiswa mampu membuat program dalam bahasa C untuk membantu memecahkan masalah ilmiah di bidang teknik Elektro.

(CLO-03) Students are able to make programs in C language to solve scientific problems in the field of electrical engineering.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

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

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

Topik/Pokok Bahasan
Main Subjects

1. Sejarah komputer.
   Computer History.
2. Sistem komputer.
   Computer system.
3. Sistem bilangan.
   Number system.
4. Ekspresi, operand dan operator.
   Expressions, operands and operators.
5. Algoritma komputer, runtunan, pengulangan dan pemilihan.
   Computer algorithms, collections, repetition and selection.
6. Bahasa pemrograman C.
   C programming language.
7. Tipe data, dan struktur.
   Data type, and structure.
8. Array.
   Array.
9. Pengurutan data .
   Sorting data.
10. Barisan dan deret.
    Sequence and series.

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] Discovering Computers: Fundamentals, Fifth Edition (Shelly Cashman Series) by Gary B. Shelly and Misty E. Vermaat [2] Fundamentals of Computer Algorithms by Ellis and Sartaj Sahni Horowitz [3] Introduction to Algorithms, Second Edition by Thomas H. Cormen Programming in ANSI C by Stephen G. Kochan
Prasyarat ***Prerequisite(s)***
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Mata Kuliah ***Course***	Nama MK *Name*	:	Rangkaian Listrik *Electric Circuits*
	Kode MK *Code*	:	EW184003
	Kredit *Credits*	:	2 sks
	Semester *Semester*	:	II (Wajib) *II (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 2 x 50 = 100 menit/minggu Latihan/tugas : 2 x 60 = 120 menit/minggu Belajar mandiri : 2 x 60 = 120 menit/minggu *Lectures : 2 x 50 = 100 min/week* *Exercises/Assignments : 2 x 60 = 120min/week* *Self learning : 2 x 60 = 120 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Hendra Kusuma, M.Eng.
	Pengajar *Lecturer*	:	Dr. Ir. Hendra Kusuma, M.Eng.
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Rangkaian Listrik membahas tentang Konsep dasar rangkaian dan analisisnya, Hukum dasar rangkaian yang meliputi Hukum Ohm dan Kirchhoff, Metoda analisis node dan mesh, Teori rangkaian yang meliputi teorema superposisi, rangkaian ekuivalen thevenin dan Norton, serta transfer daya maksimum. Topik pembahasan berikutnya adalah prinsip kerja Kapasitor dan induktor, Rangkaian dengan resistor atau induktor (orde satu), serta Rangkaian dengan resistor, kapasitor dan induktor (orde dua) baik seri maupun paralel.

Electric Circuit course discusses the basic concepts of the electric circuit and its analysis. The course includes two basic laws of the circuit (Ohm's Law and Kirchhoff's Law), two methods of analysis (nodes and mesh), some useful circuit methods (superposition theorem, thevenin equivalent circuit, Norton equivalent circuits, and maximum power transfer). The next topic of discussion is the principle of capacitors and inductors, responses of circuits with capacitor or inductor (first order circuit), and responses of circuit with resistor, capacitor and inductor (second order circuit) in both series and parallel circuits.

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-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-9) Capable to learn independently to foster lifelong learning abilities

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep dalam rangkaian listrik dan analisisnya untuk analisis dan perancangan sistem bidang teknologi elektro.
(CLO-01) Mastering the concept of electric circuits and its analysis for the purpose of analysis and system design in the field of electrical technology.

(CPMK-02) Mampu mendeskripsikan prosedur penyelesaian rangkaian listrik dan analisisnya dalam bidang teknologi elektro.
(CLO-02) Able to describe the procedure of electric circuit analysis in the field of electrical technology.

(CPMK-03) Mampu menerapkan pemikiran logis, kritis, sistematis, dan inovatif dalam materi rangkaian listrik dan analisisnya untuk konteks pengembangan atau implementasi ilmu pengetahuan dan tek nologi yang memperhatikan dan menerapkan nilai humaniora yang sesuai dengan bidang keahliannya.
(CLO-03) Able to apply logical, critical, systematic, and innovative thinking in electric circuits and its analysis to the context of the development or implementation of science and technology considering the humanities value appropriate to his/her area of expertise.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri dalam materi rangkaian listrik dan analisisnya.
(CLO-04) Demonstrate responsible attitude toward works in their field of expertise related to electrical circuitry.

Topik/Pokok Bahasan

Main Subjects

1. Konsep dasar rangkaian
   Basics concept of electric circuits

2. Hukum dasar angkaian
   Circuit laws
3. Analisis rangkaian
   Circuit analysis technique, basic Nodal and Mesh analysis
4. Teori rangkaian
   Circuit theory
5. Kapasitor dan inductor
   Capacitor and inductor
6. Rangkaian orde satu
   First order circuits
7. Rangkaian orde dua
   RLC circuits

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] Tim pengajar rangkaian listrik, Handout Mata Kuliah Rangkaian Listrik.
Electric Circuits, Lecture Notes.
[2] Pujiono, Rangkaian Listrik, Graha Ilmu,
[3] CK Alexander and MNO Sadiku, Fundamental of Electric Circuit, McGraw Hill, 8th Edition, 2013.
[4] WH Hayt, JE Kemmerly, and SM Durbin, Engineering Circuit Analysis, McGraw Hill, 8th Edition, 2007.

Prasyarat ***Prerequisite(s)***
- KM184101 Matematika I - *KM184101 Mathematics I*

Mata Kuliah ***Course***	Nama MK *Name*	:	Aljabar Linier dan Struktur Diskrit *Linear Algebra and Discrete Structures*
	Kode MK *Code*	:	EE184201
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	II (Wajib) *II (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Totok Mujiono, MI.Kom.
	Pengajar *Lecturer*	:	Dr. Ir. Totok Mujiono, MI.Kom.
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Aljabar Linier dan Struktur Diskrit merupakan mata kuliah dasar matematika yang membahas mengenai Sistem Persamaan Linier, Matriks, Determinan, Vektor, Eiegen Value & Eigen Vector, serta Konsep dasar dari Matematika diskrit. Mata kuliah ini memiliki prasyarat Matematika I.

Linear Algebra and Discrete Structure course is basic mathematics for engineering students that discusses Linear Equation Systems, Matrices, Determinants, Vector, Eigen Value & Eigen Vector, as well as the basic concepts of Discrete Mathematics. This course has Mathematics I as prerequisites.

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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep teori dasar aljabar linier yang mencakup teori sistem persamaan linier, matriks, determinan, permasalahan eigen value & eigen vector, bentuk – bentuk vektor, serta beberapa konsep matematika diskrit (Himpunan, Relasi, Graph).

(CLO-01) Mastering the basic theoretical and concepts of linear algebra which includes systems theory of linear equations, matrices, determinants, eigen value & eigen vector problems, vector forms, as well as some discrete mathematical concepts (Sets, Relations, Graphs).

(CPMK-02) Mampu memformulasikan permasalahan matematika dan menyelesaikannya menggunakan konsep sistem persamaan linier,

matriks, determinan, permasalahan eigen value & eigen vector, bentuk – bentuk vektor, serta permasalahan matematika diskrit.
(CLO-02) Able to formulate mathematical problems and solve the problem using concepts of linear equations system, matrices, determinants, eigen value & eigen vector problems, vector forms, and discrete mathematical problems.

(CPMK-03) Mampu menunjukkan kinerja mandiri, bermutu, dan terukur dalam menganalisis permasalahan matematika teknik menggunakan konsep aljabar linier dan matematika diskrit.
(CLO-03) Able to demonstrate independent, high quality, and measurable performance in analyzing mathematical problems with techniques using linear algebraic concepts and discrete mathematics.

(CPMK-04) Mampu bertanggung jawab atas hasil kerja, baik secara individu maupun kelompok.
(CLO-04) Able to be responsible for the work, both individually and in groups

Topik/Pokok Bahasan
Main Subjects

1. Sistem Persamaan Linier & Eliminasi Gauss
   Linear Equation System & Gauss Elimination
2. Operasi-operasi Matriks
   Matrix Operations
3. Determinan
   Determinants
4. Ruang Vektor (Euclidean & General)
   Vector Space (Euclidean & General)
5. Eigen Value dan Eigen Vector, Diagonalisasi
   Eigen Value and Eigen Vector, Diagonalization
6. Himpunan, Operasi Himpunan, dan Fungsi
   Sets, Set Operations, and Functions
7. Relasi

Relation

8. Grafik
   Graph

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] Howard Anton and Chriss Rorres, 11th Edition of Elementary Linear Algebra, 2014
[2] Kenneth H. Rosen, 7th Edition of Discrete Mathematics and Its Applications

Prasyarat
Prerequisite(s)

KM184101 Matematika I
KM184101 Mathematics I

Mata Kuliah ***Course***	Nama MK *Name*	:	Rangkaian Listrik Lanjut *Advanced Electric Circuits*
	Kode MK *Code*	:	EE184301
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	III (Wajib) *III (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Fajar Budiman, ST, M.Eng
	Pengajar *Lecturer*	:	Dr.Ir. Djoko Purwanto, M.Eng Dr. Ir. Hendra Kusuma, M.Eng. Dr. Ir. Totok Mujiono, MI.Kom. Dr. I Made Yulistya Negara, ST, M.Sc Vita Lystianingrum B P, ST, M.Sc, PhD Dr. Dimas Fajar Uman Putra, ST, MT Fajar Budiman, ST, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah

	Requirement and Regulation	perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Rangkaian Listrik II membahas tentang Arus, Tegangan dan Daya Listrik pada daerah Frekuensi (AC), Fungsi Sinusoida, Konsep Phasor, Analisis Steady State Sinusoida, Teorema Thevenin dan Norton, Daya AC sesaat dan Daya AC Rata-rata, Perpindahan daya maksimum, Faktor Daya, Daya Kompleks, Koreksi Faktor Daya, Rangkaian AC 3 Fasa, Pengukuran Daya 3 Fasa. Sistem Listrik 3 Fasa Seimbang dan Tak Seimbang. Pengukuran Daya Listrik 3 Fasa, Rangkaian gandeng magnetic, Trafo Linier dan Ideal, dan Trafo Auto Ideal.

Advanced Electrical Circuits is intended for use in a classroom course that deals with currents, Voltages and Power at Frequency domain, a Sinusoidal function, Phasor Concept, Steady State Sinusoidal Analysis, Thevenin and Norton Theorems, Temporary AC Power and Average AC Power, Maximum Power Transfer Theorems, Power Factor, Complex Power, Power Factor Correction, 3 phase AC Circuit, 3 Phase Power Measurement. Electrical System 3 Balanced and Unbalanced Phases. 3 phase Phase Power Measurement, magnetic coupling circuit, Linear and Ideal Transformer, as well as Ideal Auto transformer.

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-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-9) Capable to learn independently to foster lifelong learning abilities

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Mahasiswa mampu memahami teori, konsep dan prinsip rekayasa rangkaian listrik, arus, tegangan dan daya listrik AC 1 fasa dengan menggunakan konsep Phasor serta mahasiswa mampu memahami rangkaian 3 fasa, dan rangkaian gandeng magnetik.
(CLO-01) Students should be able to understand the theory, concepts and principles of electrical circuit engineering, current, voltage and AC power single phase using the Phasor concept. They also should be able to understand 3 phase circuits, as well as magnetic coupling circuits.

(CPMK-02) Mampu mendeskripsikan penyelesaian permasalahan rekayasa rangkaian listrik pada domain frekuensi dengan analisis phasor pada sistem tenaga listrik, sistem pengaturan, telekomunikasi multimedia, atau elektronika.
(CLO-02) Students should Able to describe the problem solving of electrical circuit engineering in frequency domain with phasor analysis on electric power system, control system, multimedia telecommunication, or electronics,

(CPMK-03) Mampu menganalisis dan merancang rangkaian pasif AC pada sistem tenaga listrik, sistem pengaturan, telekomunikasi multimedia, atau elektronika dengan menggunakan konsep phasor.
(CLO-03) Students should be able to analyze and design passive AC circuits on electric power system, control system, multimedia telecommunication, or electronics by using phasor concepts.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahlian analisis rangkaian AC secara mandiri khususnya dalam

menganalisis dan menyelesaikan permasalahan rangkaian di domain frekuensi.
(CLO-04) Students should show a responsible attitude towards the work in the field of AC circuit analysis independently especially in analyzing and solving circuit problems in the frequency domain.

Topik/Pokok Bahasan
Main Subjects

1. Fungsi Sinusoida,
   Sinusoidal Functions,
2. Konsep Phasor,
   Phasor Concepts,
3. Analisis Steady State AC,
   AC Steady state analysis
4. Analisis Daya Listrik AC,
   AC Power analysis
5. Rangkaian listrik 3 Fasa,
   3 Phase AC Circuits
6. Rangkaian gandeng magnetic (transformator)
   Mutual Inductance Circuits

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] Alexander Charles K., Sadiku Matthew O. N., Fundamentals of Electric Circuit, Fifth edition, McGraw-Hill, New York, 2013.
[2] Hyatt, William H.,Kemmerly Jack E, Engineering circuit analysis, McGraw-Hill, New York, 1983.
[3] Irwin, J. David, Nelms, R. Mark, Basic engineering circuit analysis, 11th edition, John Wiley & Sons, USA, 2015

Prasyarat

Prerequisite(s)

EW184003 Rangkaian Listrik

EW184003 Electric Circuits

Mata Kuliah ***Course***	Nama MK *Name*	:	Dasar Sistem dan Jaringan Telekomunikasi *Introduction to Telecommunication Systems and Networks*
	Kode MK *Code*	:	EE184302
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	III (Wajib) *III (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Gatot Kusrahardjo, MT
	Pengajar *Lecturer*	:	Ir. Gatot Kusrahardjo, MT Dr. Prasetiyono Hari Mukti, ST, M.Sc
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	A student must have attended at least 75% of the lectures to sit in the exams

Deskripsi Mata Kuliah

Description of Course

Mata Kuliah Dasar Sistem dan Jaringan Telekomunikasi membahas tentang konsep dasar Sistem Telekomunikasi dan Jaringan Data secara umum. Bagian awal mempelajari komponen dasar, klasifikasi sistem, jenis sinyal informasi, jenis medium transmisi dan berbagai macam teknik modulasi. Pada sistem nirkabel (wireless), membahas klasifikasi Spektrum Frekuensi Radio dan propagasinya, serta fungsi antenna & satelit. Untuk memberi gambaran komunikasi suara, diperkenalkan Sistem Teleponi, trafik Erlang dan teknik multipleksing. Sedangkan pada bagian transmisi data, mengambil bahasan perihal konsep jaringan, protokol jaringan, sistem internet (TCP/IP) dan proses-proses yang terjadi dalam tiap lapis jaringan. Di bagian akhir, mempelajari berbagai gangguan dan pengaruhnya dalam performansi sistem dan jaringan telekomunikasi.

This course discusses basic concepts of Telecommunications Systems and Data Networks in general. It begins with study on basic components, system classification, type of information signal, type of transmission medium and various modulation techniques. Wireless system part discusses radio frequency spectrum classification and its propagation, as well as antenna & satellite functions. To give an overview of voice communication, Telephony Systems, Erlang traffic and multiplexing techniques are introduced. Concept of networks, network protocols, internet systems (TCP / IP) and processes that occur within each layer of the network are discussed in data transmission section. Finally, various disturbances and their effects on the performance of telecommunication systems and networks are studied.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Mengenal konsep dasar sistem telekomunikasi serta prinsip kerja jaringan data secara umum.
(CLO-01) Understanding the basic concepts of telecommunications systems and the principles of data networks in general.

(CPMK-02) Memahami prinsip kerja jaringan internet dan kedudukan informasi (konten) internet yang bersifat Over The Top (OTT).
(CLO-02) Understanding the working principle of internet networks and the position of Over The Top (OTT) internet information and content.

(CPMK-03) Memahami secara logis potensi gangguan yang muncul dan mempengaruhi performansi sistem telekomunikasi dan jaringan internet secara umum.
(CLO-03) Understanding the potential of interference that arises and affects the performance of telecommunications systems and internet networks in general.

(CPMK-04) Menunjukkan sikap bertanggungjawab dan bijaksana dalam bertelekomunikasi, khususnya ketika menggunakan jaringan internet (TCP/IP).

(CLO-04) Demonstrate a responsible and wise attitude in telecommunications, especially when using the internet network (TCP / IP).

Topik/Pokok Bahasan

Main Subjects

1. Komponen dasar, Klasifikasi Sistem dan Sejarah Telekomunikasi
   Basic components, Classification of Systems and History of Telecommunications
2. Sumber Informasi, Konsep frekuensi & bandwidth serta Jenis pengkodean sinyal informasi
   Information Sources, Concepts of frequency & bandwidth and Types of information signal coding
3. Medium Transmisi dan Karakteristiknya
   Transmission Medium and Characteristics
4. Teknik Modulasi
   Modulation Technique
5. Spektrum frekuensi & Propagasi gelombang radio
   Frequency spectrum & radio wave propagation
6. Sistem Teleponi & Trafik Erlang
   Erlang Telephony & Traffic System
7. Teknik Multipleksing
   Multiplexing technique
8. Topologi jaringan, Protokol Jaringan dan Sistem internet (TCP/IP)
   Network topology, Network Protocol and Internet System (TCP/IP)
9. Konsep Paketisasi, Error checking, Routing dan Flow control
   Package concept, Error checking, Routing and Flow control
10. Gangguan & Performansi Sistem Telekomunikasi
    Disruption & Performance of Telecommunications Systems

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] Roger L. Freeman, Fundamental of Telecommunications, Second Edition, John Wiley & Sons, 2005
[2] Stallings, W., Data and Computer Communications, 10th Edition. Upper Saddle River, NJ, USA, Prentice Hall, 2014
[3] Gupta, Prakash C., Data Communications and Computer Networks, Prentice Hall of India, New Delhi, 2006.
[4] Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Fifth Edition, Pearson, 2013
[5] Shanmugam, K.Sam, Digital and Analog Communication, John Wiley and Sons (WIE), International Edition, 1979.
[6] Simon Saunders, Alejandro Aragón-Zavala, Antennas and Propagation for Wireless Communication Systems, 2nd Edition, John Wiley & Sons Ltd., 2007.

Prasyarat

Prerequisite(s)

EW184001 Pengantar Teknologi Elektro

EW184001 Introduction to Electrical Technology

Mata Kuliah ***Course***	Nama MK *Name*	:	Medan Elektromagnetik *Electromagnetic Fields*
	Kode MK *Code*	:	EE184303
	Kredit *Credits*	:	4 sks
	Semester *Semester*	:	III (Wajib) *III (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 240 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Feby Agung Pamuji, ST, MT
	Pengajar *Lecturer*	:	Dr. Feby Agung Pamuji, ST, MT Dr. Ir. Achmad Mauludiyanto, MT Dr. I Made Yulistya Negara, ST, M.S Devy Kuswidiastuti, ST, M.Sc Dr. Ir. Ni Ketut Aryani, MT Eko Setijadi, ST, MT, PhD Dr. I Gusti Ngurah Satriyadi Hernanda, ST, MT Dr. Prasetiyono Hari Mukti, ST, M.Sc Dr. Dimas Fajar Uman Putra, ST, MT Dr. Ir. Puji Handayani, MT Dr. Dimas Anton Asfani, ST, MT

			Sri Rahayu, ST, M.Kom Vita Lystianingrum B P, ST, M.Sc, PhD Prof. Dr.Ir. Gamantyo Hendrantoro, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Medan Elektromagnetik merupakan mata kuliah yang membahas teori dasar medan elektromagnetik serta aplikasinya pada teori bahan konduktor, semionduktor dan kapasitor. Selain itu, Mata kuliah ini memberikan pengetahuan mengenai konsep medan elektromagnetik yang tetap dan berubah terhadap waktu serta penerapannya dalam komponen maupun mesin listrik. Juga membahas medan magnet statis, medan dinamis dan aplikasinya.

Electromagnetic Field discusses the basic theory of electromagnetic fields and their application to the theory of conductor materials, semiconductors and capacitors. In addition, this course provides knowledge about the concepts of static and time-varying electromagnetic fields and their application in electrical components and machines. Also discusses static magnetic fields, dynamic fields and their applications.

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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep teori dasar medan elektromagnetik yang mencakup teori medan elektrostatis, electromagnet tetap dan berubah terhadap waktu, serta hukum – hukum dasar yang mendukung.
(CLO-01) Mastering the basic concepts of electromagnetic fields which include electrostatic field theory, electromagnetics field which either is static or changing against time, as well as related basic laws.

(CPMK-02) Menguasai konsep medan magnet statis, konsep medan elektromagnet dinamis, persamaan Maxwell serta aplikasinya.
(CLO-02) Mastering the concept of static magnetic fields, the concept of dynamic electromagnetic fields, Maxwell's equations and their applications.

(CPMK-03) Mampu menganalisis permasalahan medan elektrostatis, electromagnet tetap dan berubah terhadap waktu, dan menggunakan hukum-hukum dasar yang berkaitan.
(CLO-03) Able to analyze the problems of the electrostatic field and to use the related basic laws.

(CPMK-04) Mampu menganalisis persoalan-persoalan medan magnet statis dan medan elektromagnet dinamis serta mampu menganalisis perambatan gelombang datar serbasama di berbagai medium.
(CLO-04) Able to analyze the problems of static magnetic fields and dynamic electromagnetic fields and be able to analyze the propagation of flat waves together in various mediums.

(CPMK-05) Mampu menunjukkan kinerja mandiri, bermutu, dan terukur dalam menganalisis permasalahan.
(CLO-05) Able to work independently, to show quality and measurable performance in analyzing problems.

(CPMK-06) Mampu menganalisis permasalahan medan elektrostatis, electromagnet tetap dan berubah terhadap waktu.
(CLO-06) Able to analyze problems in electrostatic fields and electromagnetics in static and changing against time.

(CPMK-07) Mampu bertanggung jawab atas hasil kerja, baik secara individu maupun kelompok.
(CLO-07) Able to be responsible for the work, both individually and in groups.

Topik/Pokok Bahasan
Main Subjects

1. Vektor, Hukum Coulomb, dan Intensitas Medan Listrik
   Vector, Coulomb Law, and Electric Field Intensity
2. Kerapatan Fluks Listrik, Hukum Gauss, dan Divergensi
   Electric Flux Density, Gauss Law, and Divergence
3. Energi dan Potensial
   Energy and Potential
4. Konduktor, Dielektrikum, dan Kapasitansi
   Conductor, Dielectric and Capacitance
5. Medan Magnet Statis
   Static Magnetic Field

6. Bahan & Gaya Magnet, Induktansi
   Material & Magnetism, Inductance
7. Medan yang berubah terhadap waktu, Teorema Maxwell
   The field changes with time, Maxwell's theorem
8. Gelombang Datar Serbasama
   Uniform Plane Wave

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] William H. Hayt, Jr. John A. Buck, 8th Edition of Engineering Electromagnetics, McGraw-Hill, 2010
[2] Joseph Edminister, Schaum's Outline of Electromagnetics Schaum's Outline of Electromagnetics, 2013

Prasyarat
Prerequisite(s)

EE184201 Aljabar Linier dan Struktur Diskrit
EE184201 Linear Algebra and Discrete Structures

Mata Kuliah ***Course***	Nama MK *Name*	:	Persamaan Differensial Biasa dan Parsial *Partial and Ordinary Differential Equations*
	Kode MK *Code*	:	EE184304
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	III (Wajib) *III (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. I Gusti Ngurah Satriyadi Hernanda, ST, MT
	Pengajar *Lecturer*	:	Dr. I Gusti Ngurah Satriyadi Hernanda, ST, MT Dr. Dimas Fajar Uman Putra, ST, MT Ir. Ali Fatoni, MT Mochammad Sahal, ST, M.Sc Dr.Ir. Suwadi, MT Dr.Ir. Wirawan, DEA Dr. Ir. Hendra Kusuma, M.Eng.
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*

	Persyaratan dan Peraturan *Requirement and Regulation*	: Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata Kuliah Persamaan Diferensial Biasa dan Parsial membahas tentang konsep dan metode penyelesaian Persamaan Diferensial Biasa dan Parsial , Integral Vektor (Integral garis dan Permukaan), serta penggunaannya dalam penyelesaian permasalahan teknik elektro.

Ordinary Differential Equations and Partials discusses the concepts and methods of solving Ordinary and Partial Differential Equations, Integral Vector (Integral lines and Surfaces), and their use in solving electrical engineering problems.

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-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-9) Capable to learn independently to foster lifelong learning abilities

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep, prosedur dan prinsip penyelesaian permasalahan dalam bentuk Persamaan Diferensial Biasa dan Parsial, Integral Vektor (Integral Garis dan Permukaan).
(CLO-01) Mastering concepts, procedures and principles of problem solving in the Ordinary and Partial Differential Equations forms, Integral Vector (Lines and Surfaces Integral).

(CPMK-02) Mampu memformulasikan permasalahan dalam bentuk Persamaan Diferensial Biasa dan Parsial, Integral Vektor (Integral Garis dan Permukaan).
(CLO-02) Able to formulate problems in the form of Ordinary and Partial Differential Equations, Integral Vector (Lines and Surfaces integration).

(CPMK-03) Mampu melakukan proses evaluasi untuk mendapatkan penyelesaian permasalahan dalam bentuk Persamaan Diferensial Biasa dan Parsial, Integral Vektor (Integral Garis dan Permukaan).
(CLO-03) Able to carry out an evaluation process to get a solution to the problem in the form of Ordinary and Partial Differential Equations, Integral Vector (Lines and Surfaces integration).

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

(CPMK-05) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-05) Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan
Main Subjects

1. PD Biasa (PD Orde 1, PD Orde 2 dan PD Orde Tinggi).
   Ordinary Differential Equation (ODE 1, ODE 2, and higher).

2. Sistem Persamaan Diferensial
   Differential Equation System
3. Deret Fourier dan Integral Fourier
   Fourier and Integral Fourier series
4. PD Parsial
   Partial Differential Equation
5. Integral Vektor (Integral Garis, integral Permukaan)
   Integral Vector (Lines and Surface Integral)

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] Kreyszig, Erwin : "Advanced Engineering Mathematics, 10th Edition", John Wiley & Sons, Inc, 2011
[2] Robinson, James C, " An Itroduction to Ordinary Differential Equation", Cambridge University Press, 2004.

Prasyarat
Prerequisite(s)

EE184201 Aljabar Linier dan Struktur Diskrit
EE184201 Linear Algebra and Discrete Structures

Mata Kuliah ***Course***	Nama MK *Name*	:	Sinyal dan Sistem *Signals and Systems*
	Kode MK *Code*	:	EE184305
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	III (Wajib) *III (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	M. Abdul Hady, ST, MT
	Pengajar *Lecturer*	:	M. Abdul Hady, ST, MT Ir. Ali Fatoni, MT Eka Iskandar, ST, MT Mochammad Sahal, ST, M.Sc Ir. Rusdhianto Effendie AK, MT Yusuf Bilfaqih, ST, MT Zulkifli Hidayat, ST, M.Sc
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah

	Requirement and Regulation	perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Sinyal dan Sistem membahas tentang representasi sinyal dan sistem, konsep sistem Linear Time-Invariant (LTI) waktu kontinu, deret Fourier sinyal waktu kontinu, transformasi Fourier waktu kontinu dan aplikasinya, transformasi Laplace dan aplikasinya, konsep sistem LTI waktu diskrit, deret Fourier sinyal waktu diskrit, transformasi Fourier waktu diskrit dan transformasi Z.

The Signal and System course discusses the representation of signals and systems, the concept of a continuous time-invariant Linear Time-Invariant (LTI) system, Fourier series of continuous time signals, Fourier continuous time transformations and their applications, Laplace transforms and their applications, the discrete-time LTI system concepts, Fourier series discrete time signal, Fourier time discrete transformation and Z transformation.

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-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 sinyal dan sistem linear dalam ranah waktu, ranah frekuensi dan frekuensi kompleks.
(CLO-01) Mastering the concept of signals and linear systems in the complex domain, frequency and frequency domains.

(CPMK-02) Mampu menganalisis sinyal dan sistem linear time-invariant ranah waktu kontinu dan ranah waktu diskrit.
(CLO-02) Able to analyze signals and linear time-invariant systems in the continuous time domain and discrete time domain.

(CPMK-03) Mampu menggunakan software Matlab/Simulink untuk melakukan visualisasi dan eksperimentasi konsep sinyal dan sistem linear.
(CLO-03) Able to use Matlab / Simulink software to visualize and experiment the concepts of signals and linear systems.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-04) Demonstrate a responsible attitude towards the work in the field of expertise independently.

(CPMK-05) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-05) Working together to be able to take full advantage of their potential.

Topik/Pokok Bahasan

Main Subjects

1. Konsep Sinyal dan Sistem
   Signal and System Concepts
2. Sistem LTI Waktu Kontinu

Continuous Time LTI System

3. Transformasi Fourier Waktu Kontinu
   Continuous Time Fourier Transform
4. Transformasi Laplace
   Laplace transform
5. Sistem LTI Waktu Diskrit
   Discrete Time LTI System
6. Transformasi Fourier Waktu Diskrit
   Fourier Time Discrete Transformation
7. Transformasi Z
   Z-transform

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] Fatoni, Ali. “Diktat Sistem Linear”
[2] S.Soliman, Samir and D.Srinath,M. : "Continous and Discrete Signal and Systems", Prentice-Hall, Englewood Cliffs, New Jersey 1990.
[3] V. Oppenheim, A and T. Young, Ian : "Signal and Systems", Prentice-Hall of India, New Delhi 1990
[4] Sanjit K Mitra: “Digital Signal Processing : A Computer - Based Approach.” 4th Edition. Mcgraw Hill Education, 2013

Prasyarat

Prerequisite(s)
EW184003 Rangkaian Listrik *EW184003 Electric Circuits*

Mata Kuliah ***Course***	Nama MK *Name*	:	Rangkaian Elektronika *Electronic Circuits*
	Kode MK *Code*	:	EE184306
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	III (Wajib) *III (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Eng Mohammad Attamimi B. Eng. M. Eng
	Pengajar *Lecturer*	:	Dr. Eng Mohammad Attamimi B. Eng. M. Eng Fajar Budiman, ST, M.Eng Ir. Harris Pirngadi, MT Dr. Ir. Totok Mujiono, MI.Kom. Dr. Mohammad Rivai, ST, MT Ir. Tasripan, MT Astria Nur Irfansyah, ST, M.Eng, PhD
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*

	Persyaratan dan Peraturan *Requirement and Regulation*	: Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Rangkaian Elektronika membahas tentang proses analisis, simulasi, perancangan dan deskripsi aplikasi komponen Dioda Semikonduktor, Bipolar Junction Transistor, Field-Effect Transistor, Respon frekuensi rangkaian transistor, Power Amplifier, Rangkaian Differential Amplifier, Rangkaian Feedback dan Oscillator, Rangkaian Power Supply, Komponen Silicon-Controlled Rectifier, Diode Alternating Current, Triode for Alternating Current, Unijunction Transistor, Programmable Unijunction Transistor.

The course of Electronic Circuits discusses: Analysis, simulation, design, and application of Semiconductor Diode, Bipolar Junction Transistor, and Field-Effect Transistor circuits; Analysis of frequency response of the transistor circuits; Analysis of Power Amplifier, Differential Amplifier, Feedback & Oscillator, and Power Supply circuits; Analysis, simulate, design, and application of Silicon-Controlled Rectifier, Alternating Current Diode, Triode for Alternating Current, Unijunction Transistor, and Programmable Unijunction Transistor circuits.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-3) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-9) Capable to learn independently to foster lifelong learning abilities

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep dan prinsip komponen elektronika untuk menunjang keperluan proses analisis, simulasi, perancangan dan deskripsi aplikasi rangkaian elektronika.
(CLO-01) Mastering the concepts and principles of electronic components for analysis, simulation, design, and application of electronic circuits.

(CPMK-02) Mampu mendeskripsikan proses analisis, simulasi, perancangan dan aplikasi rangkaian elektronika.
(CLO-02) Able to describe the analysis, simulation, design, and application of electronic circuits.

(CPMK-03) Mampu menerapkan proses analisis, simulasi, perancangan dan deskripsi aplikasi rangkaian elektronika.
(CLO-03) Able to apply the analysis, simulation, design, and application of electronic circuits.

(CPMK-04) Menunjukkan sikap bertanggungjawab yang berkenaan dengan proses analisis, simulasi, perancangan dan deskripsi aplikasi rangkaian elektronika secara mandiri.
(CLO-04) Demonstrating attitude of responsibility regarding the analysis, simulation, design, and application of electronic circuits independently.

Topik/Pokok Bahasan
Main Subjects

1. Dioda Semikonduktor
   Semiconductor Diode
2. Bipolar Junction Transistor
   Bipolar Junction Transistor
3. Field-Effect Transistor
   Field-Effect Transistor
4. Respon Frekuensi Rangkaian Transistor
   The frequency response of the transistor circuits
5. Power Amplifier
   Power Amplifier
6. Differential Amplifier
   Differential Amplifier
7. Rangkaian Feedback dan Oscillator
   Feedback & Oscillator
8. Power Supply
   Power Supply

9. Silicon-Controlled Rectifier, Diode Alternating Current, Triode for Alternating Current, Unijunction Transistor, Programmable Unijunction Transistor
   Silicon-Controlled Rectifier, Alternating Current Diode, Triode for Alternating Current, Unijunction Transistor, and Programmable Unijunction Transistor circuits

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] Muhammad Rivai, 2018. Diktat: Rangkaian Elektronika.
Muhammad Rivai, 2018. Lecture Note: Electronic Circuits
[2] Robert L Boylestad and Louis Nashelsky, 2012. Electronic Devices and Circuit Theory, Prentice Hall, Inc.

Prasyarat
Prerequisite(s)

EE184003 Rangkaian Listrik (untuk mahasiswa DTE) atau
SF184202 Fisika II (untuk mahasiswa Departemen lain)
EW184003 Electrical Circuits (for students of the EED) or
SF184202 Physics II (for students of the other Departments)

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Digital dan Mikroprosesor *Digital and Microprocessor Systems*
	Kode MK *Code*	:	EE184401
	Kredit *Credits*	:	4 sks
	Semester *Semester*	:	IV (Wajib) *IV (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 240 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Astria Nur Irfansyah, ST, M.Eng, PhD
	Pengajar *Lecturer*	:	Astria Nur Irfansyah, ST, M.Eng, PhD
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini membahas teori dan perancangan sistem digital, komponen dasar sistem digital dan sistem mikroprosesor beserta komponen penyusunnya. Implementasi rangkaian digital meliputi implementasi rangkaian kombinasional dan sekuensial, dan diarahkan sebagai dasar implementasi sistem mikroprosesor yang meliputi aspek arsitektur hingga pada level gerbang logika. Pembahasan sistem mikroprosesor juga meliputi aspek pemrograman Assembly, konsep subrutin, stack, dan interupsi, teknik antarmuka input/output dan memori.

This course discusses the theory and design of digital systems, basic components of digital and microprocessor systems and their constituent components. The implementation of digital circuits includes the implementation of combinational and sequential circuits, and is directed as the basis for implementing the microprocessor system which includes architectural aspects up to the logic gate level. The discussion of microprocessor systems also includes aspects of Assembly programming, the concept of subroutines, stacks and interrupts, input/output interface techniques and memory.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-3) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-9) Capable to learn independently to foster lifelong learning abilities

(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 dasar sistem dan teknologi digital meliputi sistem bilangan biner, gerbang logika, rangkaian kombinasional, rangkaian sekuensial, teknologi IC digital, serta prinsip sistem mikroprosesor yang meliputi aspek implementasi pada level register transfer dan gerbang logika, aspek piranti lunak berupa program yang dieksekusi mikroprosesor, serta aspek pengembangan sistem berbasis mikroprosesor.

(CLO-01) Mastering basic digital systems and technology including binary number systems, logic gates, combinational circuits, sequential circuits, digital IC technology, and microprocessor system principles which include implementation aspects at the transfer register and logic gate levels, software aspects in the form of programs executed by microprocessors, and aspects of developing microprocessor-based systems.

(CPMK-02) Mampu melakukan penyederhanaan implementasi rangkaian kombinasional dengan teknik Karnaugh Map.

(CLO-02) Able to simplify the implementation of combinational circuits using the Karnaugh Map technique.

(CPMK-03) Mampu merancang dan melakukan simulasi desain ALU (arithmetic logic unit) dan microarchitecture CPU (central processing unit) berdasarkan sebuah instruction set sederhana.
(CLO-03)

Able to design and simulate ALU (arithmetic logic unit) and CPU (central processing unit) microarchitecture designs based on a simple instruction set.

(CPMK-04) Mampu menyusun program aras rendah untuk sistem mikroprosesor.
(CLO-04) Able to compile low level programs for microprocessor systems.

(CPMK-05) Mampu merancang sistem minimal berbasis mikroprosesor.
(CLO-05) Able to design microprocessor-based minimal systems.

(CPMK-06) Memahami konsep sistem komputer beserta komponen penyusunnya seperti CPU, I/O unit, memory unit, dan instruction set, sehingga mampu mengeksekusi program.
(CLO-06) Understanding the concept of a computer system and its constituent components such as CPU, I / O unit, memory unit, and instruction set, that they are able to execute programs.

(CPMK-07) Memahami konsep perancangan digital, bahasa pemrograman untuk sistem mikroprosesor.
(CLO-07) Understanding the concept of digital design, a programming language for microprocessor systems.

(CPMK-08) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-08) Demonstrate an attitude of responsibility for work in their field of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Teori teknik digital, sistem bilangan biner, aljabar Boolean, gerbang logika.
   Digital engineering theory, binary number system, Boolean algebra, logic gates.
2. Rangkaian kombinasional, Sum of product, penyederhanaan rangkaian kombinasional, teknik Karnaugh map.
   Combinational sequences, Sum of product, simplification of combinational circuits, Karnaugh map technique.
3. Rangkaian sekuensial, state machine, flip flop, register.
   Sequential circuits, state machines, flip flops, registers.
4. Aritmetika digital, adder, two's complement, BCD, floating point, pengali, carry propagation.
   Digital arithmetic, adder, two's complement, BCD, floating point, multiplier, carry propagation.
5. Teknologi IC digital, logic families, noise margin, TTL, CMOS, fan in/fan out.
   Digital IC technology, logic families, noise margin, TTL, CMOS, fan in / fan out.
6. Model dan arsitektur komputer (CPU, I/O, memori, bus data dan instruksi, arsitektur Von Neumann, arsitektur Harvard, pengalamatan memori, set instruksi, kode mesin)
   Computer model and architecture (CPU, I / O, memory, data and instruction bus, Von Neumann architecture, Harvard architecture, memory addressing, instruction set, machine code)
7. Dasar pemrograman sistem mikroprosesor dengan assembly, development toolchain, subrutin, stack, dan interrupt.
   Basic programming of microprocessor systems with assembly, development toolchain, subroutines, stack, and interrupts.
8. Teknik antarmuka, memory interfacing, input-output port.
   Interface techniques, memory interfacing, input-output port.

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] David Harris & Sarah Harris, “Digital Design and Computer Architecture”, 2nd edition, Morgan Kaufmann, 2013, USA.
[2] Morris Mano, Charles Kime, “Logic and Computer Design Fundamentals”, 5th edition, Pearson, 2015.
[3] David A. Patterson dan John L. Hennessy, “Computer Organization & Design: The Hardware / Software Interface”, Morgan Kaufmann, 2017, USA.

Prasyarat
Prerequisite(s)

EW184102 Dasar Pemrograman
EW184102 Basic Programming

Mata Kuliah ***Course***	Nama MK *Name*	:	Dasar Sistem Tenaga Listrik *Introduction to Power System*
	Kode MK *Code*	:	EE184402
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	IV (Wajib) *IV (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. I Made Yulistya Negara, ST, M.Sc
	Pengajar *Lecturer*	:	Dr. I Made Yulistya Negara, ST, M.Sc Dr. Ir. Ni Ketut Aryani, MT Ir. Sjamsjul Anam, MT Dr. Dimas Fajar Uman Putra, ST, MT Dr. Ir. Soedibyo, MMT Vita Lystianingrum B P, ST, M.Sc, PhD Dr. Feby Agung Pamuji, ST, MT Dr. I Gusti Ngurah Satriyadi Hernanda, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*

	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Matakuliah Dasar Sistem Tenaga Listrik menjelaskan tentang prinsip konversi energi listrik berbasis fossil fuel maupun energi terbarukan serta permasalahan energi yang terjadi saat ini dan yang akan datang. Pada mata kuliah ini dikenalkan tiga aspek STL yakni proses pembangkitan, penyaluran daya listrik dan sistem pendistribusianya. Prinsip dasar perubahan energi melalui peralatan listrik berdasar peralatan listrik yang banyak digunakan di industri seperti transformator, generator dan motor. Selain itu juga dikenalkan peralatan konversi berbasis elektronika daya.

Basic courses of electric power system explain about electric energy conversion principle, current and future energy problem, electric power distribution process and distribution system, basic principle of energy change through electrical appliance called electric machine that is generator and motor.

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-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Memahami prinsip konversi energi listrik dan proses penyaluran dan pendistribusian daya listrik beserta indek keandalanya.
(CLO-01) Understand the principle of conversion of electrical energy and the process of distribution and distribution of electrical power and its signature index.

(CPMK-02) Memahami permasalahan energi yang terjadi saat ini dan yang akan datang.
(CLO-02) Understanding current and future energy problems.

(CPMK-03) Memahami prinsip dasar perubahan energi melalui eralatan listrik yang disebut mesin listrik yaitu generator dan motor.
(CLO-03) Understand the basic principle of energy changes through electrical equipment called electrical machines namely generators and motors.

(CPMK-04) Mampu menjelaskan prinsip konversi energi listrik dan proses penyaluran dan pendistribusian daya listrik beserta indek keandalanya.

(CLO-04) Able to explain the principle of electrical energy conversion and the process of distributing and distributing electrical power along with its signature index.

(CPMK-05) Mampu membuat artikel tentang permasalahan energi yang terjadi saat ini dan yang akan datang.
(CLO-05) Able to make an article about energy problems that occur today and in the future.

(CPMK-06) Mampu memodelkan peralatan model peralatan listrik yang menggunakan software aplikasi.
(CLO-06) Able to model equipment of electrical equipment using application software.

Topik/Pokok Bahasan
Main Subjects

1. Pengenalan sistem pembangkit tenaga listrik dan energi terbarukan
   Introduction of power generation systems and renewable energy.
2. Mekanisme konversi energi termasuk rangkaian elektromagnetik
   Energy conversion mechanism including electromagnetic circuits.
3. Sistem satu fasa dan 3 fasa (daya, tegangan, arus, konversi star delta)
   Single phase and 3 phase systems (power, voltage, current, star delta conversion).
4. Generator sinkron dan motor induksi
   Synchronous generator and induction motor.
5. Dasar Transformator
   Basic of transformer
6. Pengenalan sistem transmisi
   Introduction of transmission system
7. Dasar sitem distribusi termasuk indek keandalan sistem distribusi

Basic system of distribution including distribution system reliability index.

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] Gupta, Transmission and Distribution, 1997
[2] Pabla, AS, Sistem Distribusi Daya Listrik, Penerbit Erlangga
[3] Luces M. Faulkenberry, Electrical Distribution and Transmission, Prentice Hall ,1996
[4] Electrical Transmision & Distribution Reference Book, CSE WestingHouse EC.

Prasyarat
Prerequisite(s)

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Mata Kuliah ***Course***	Nama MK *Name*	:	Pengolahan Sinyal Digital *Digital Signal Processing*
	Kode MK *Code*	:	EE184403
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	IV (Wajib) *IV (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Titiek Suryani, MT
	Pengajar *Lecturer*	:	Dr. Ir. Titiek Suryani, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Pengolahan Sinyal Digital membahas tentang sinyal diskrit dan konsep sistem LTI waktu diskrit, bagaimana rangkaian realisasi sistem waktu diskrit berdasarkan persamaan beda, analisis frekuensi sinyal dan sistem waktu diskrit, konsep mengubah sinyal waktu kontinyu menjadi sinyal waktu diskrit dengan teknik sampling, teori Nyquist dan aliasing, analisis sinyal dan sistem waktu diskrit menggunakan transformasi Z, algoritma DFT-IDFT, dan FFT-IFFT untuk analisis frekuensi sinyal dan sistem secara komputasi, disain filter Finite Impulse Response (FIR) dan Infinite Impulse Response (IIR).

Digital Signal Processing course discusses discrete signals and discrete time LTI system concepts, how a series of discrete time system is realized based on different equations, signal frequency analysis and discrete time systems, the concept of converting continuous time signals into discrete time signals with sampling techniques, Nyquist theorem and aliasing, signal analysis and discrete time systems use Z transforms, DFT-IDFT algorithms, and FFT-IFFT for computational signal and system analysis, Finite Impulse Response (FIR) and Infinite Impulse Response (IIR) filters.

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-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-3) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep sinyal dan sistem diskrit dalam ranah waktu, ranah frekuensi dan frekuensi kompleks serta disain filter digital IIR dan FIR.
(CLO-01) Mastering the concepts of discrete signals and systems in the time domain, complex frequency and frequency domains and digital filter design IIR and FIR.

(CPMK-02) Mampu menganalisis sinyal dan sistem diskrit dalam ranah waktu, ranah frekuensi dan frekuensi kompleks serta disain filter digital IIR dan FIR.
(CLO-02) Able to analyze discrete signals and systems in time domain, complex frequency and frequency domains as well as digital filter design IIR and FIR

(CPMK-03) Mampu menggunakan software Matlab/Simulink untuk melakukan visualisasi dan eksperimentasi konsep sinyal dan sistem linear waktu diskrit serta disain filter digital IIR dan FIR.
(CLO-03) Able to use Matlab / Simulink software to visualize and experiment signal concepts and discrete time linear systems and design digital filters IIR and FIR.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-04) Demonstrate the attitude of being responsible for work in his area of expertise independently.

(CPMK-05) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-05) Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan
Main Subjects

1. Konsep Sinyal dan system waktu diskrit
   Concept of Signal and System of Discrete Time
2. Sistem LTI waktu diskrit
   Linear Time Invariant Discrete Time
3. Analisis frekuensi Sinyal dan Sistem LTI waktu diskrit
   Frequency Analysis of Signal and Linear Time Invariant System in Discrete Time
4. Sampling dan Rekonstruksi
   Sampling and Reconstruction Sampling dan Rekonstruksi
5. Transformasi-Z
   Z Transform
6. DFT-IDFT dan FFT-IFFT
   DFT-IDFT and FFT-IFFT
7. Disain Filter Digital FIR
   FIR Digital Filter Design
8. Disain Filter Digital IIR
   IIR Digital Filter Design

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 G Proakis and Dimitris G, Manokalis, Digital Signal Processing: Principles, algoritms and applications, 4th Edition, Pearson International Edition, Pearson Prentice-Hall, NewJersey, 2007.
[2] Monson H Hayes, Digital Signal Processing, Schaum's Outline Series, McGraw-Hill Companies, Inc., USA, 1999
[3] Lonnie C Ludeman, Fundamentals of Digital Signal Processing, Wiley,1986.
[4] Viney K Ingle and John G Proakis, Digital Signal Processing using Matlab, 3rd Ed., CENGAGE Learning, USA, 2012.

Prasyarat

Prerequisite(s)

EE184305 Sinyal dan Sistem

EE184305 Signals and Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Dasar Sistem Pengaturan *Introduction to Control Systems*
	Kode MK *Code*	:	EE184404
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	IV (Wajib) *IV (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Rusdhianto Effendie AK, MT
	Pengajar *Lecturer*	:	Ir. Rusdhianto Effendie AK, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Dasar Sistem Pengaturan merupakan mata kuliah yang mendasari ilmu pada bidang studi teknik sistem pengaturan. Mata kuliah ini mempelajari tentang bagaimana sistem pengaturan bekerja, bagaimana mendesain serta menganalisisnya. Materi yang dipelajari sebagai pengantar meliputi definisi sistem pengaturan, komponen-komponen sistem, konfigurasi sistem open loop dan closed loop serta contoh aplikasinya. Kemudian dilanjutkan dengan mempelajari pemodelan sistem mulai dari sistem elektrik, mekanik dan elektro-mekanik. Selanjutnya, hal yang dipelajari yaitu tentang diagram blok, diagram aliran sinyal, karakteristik respon sistem dalam domain waktu dan kestabilan sistem. Terakhir, membahas tentang desain kontroler PID serta teknik tuning-nya.

Introduction to Control Systems is the underlying subject of the control system engineering field of studies. This course discusses how it works, how to design and analyze it. The learning materials as introductory notions are control system components, open loop and closed loop system configurations and examples of its applications. Then forwarded with system modelling of electrical, mechanical and electro-mechanical systems. Furthermore, the important thing is about the block diagram, the signal flow diagram, the system characteristics, response analysis in the time domain and the system stability. Having completed the concept, it also learns about the design of PID controllers and its tuning method.

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-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Mampu menjelaskan konsep dan prinsip pemodelan sistem, analisis kestabilan, menentukan spesifikasi respon dan perancangan sistem pengaturan

(CLO-01) Ability to explain system modelling concepts and principles, stability analysis, determine response specifications and control system design.

(CPMK-02) Mampu memodelkan sistem, menganalisia kestabilan sistem, menentukan spesifikasi respon dan merancang sistem pengaturan.

(CLO-02) Able to model the system, analyze the stability of the system, determine the response specifications and design the control system.

(CPMK-03) Mampu menggunakan software simulasi Matlab atau yang sejenisnya untuk analisis dan visualisasi respon sistem pengaturan.

(CLO-03) Able to use Matlab simulation software or the like for analysis and visualization of system responses.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahlian sistem pengaturan.

(CLO-04) Have a passion to improve knowledge in the field of control systems to improve the quality of Indonesian society in the mastery of technology.

Topik/Pokok Bahasan

Main Subjects

1. Definisi dan konsep sistem pengaturan
   Definition and concept of control system
2. Model matematika sistem dinamik dalam bentuk persamaan differensial, fungsi alih, diagram blok, dan grafik aliran sinyal
   Dynamic system mathematical model in the form of differential equations, transfer function, block diagram, and graph of signal flow
3. Spesifikasi respon sistem
   Specification of system response
4. Analisis Kestabilan Sistem
   System Stability Analysis
5. Perancangan kontroler PID secara analitik
   Design of PID controller analytically
6. Tuning kontroler PID dengan metode Ziegler-Nichols
   Tuning PID controller with Ziegler-Nichols method
7. Simulasi sistem pengaturan menggunakan kontroler PID
   Control system simulation with PID controller

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] Ogata, Katsuhiko: "Modern Control Engineering", 3rd Ed., Prentice-Hall 1997 [2] Kuo, Benjamin C. "Automatic Control System 8th Ed." [3] Jacob, J.M.: "Industrial Control Electronics: Application and Design", PHI 1989
Prasyarat ***Prerequisite(s)***
EE184305 Sinyal dan Sistem *EE184305 Signals and Systems*

Mata Kuliah ***Course***	Nama MK *Name*	:	Probabilitas Statistik dan Proses Stokastik *Probability, Statistics, and Stochastic Processes*
	Kode MK *Code*	:	EE184405
	Kredit *Credits*	:	4 sks
	Semester *Semester*	:	IV (Wajib) *IV (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 240 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Ali Fatoni, MT
	Pengajar *Lecturer*	:	Ir. Ali Fatoni, MT Yusuf Bilfaqih, ST, MT Zulkifli Hidayat, ST, M.Sc Dr.Trihastuti Agustinah, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	Requirement and Regulation	*A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Pada mata kuliah ini mahasiswa akan mempelajari prinsip dan metode statistik dan proses stokastik beserta aplikasinya di bidang teknik elektro. Pada bagian pertama dijelaskan mengenai deskripsi visual dan kualitatif data, probabilitas, variabel acak diskrit dan kontinyu, distribusi probabilitas, distribusi gabungan, pencuplikan acak, estimasi parameter, interval statistik, uji hipotesa, dan regresi linier. Selain itu akan dibahas desain eksperimen dan analisa data hasil pengukuran. Sedangkan pada bagian kedua dijelaskan tentang konsep proses stokastik, analisa sistem linier kontinyu dan diskrit dengan bantuan konsep probabilitas dan proses stokastik baik dalam domain waktu dan frekuensi serta proses Markov.

In this course students will learn the principles and methods of statistics and stochastic processes and their applications in electrical engineering. First part describes the visual and qualitative descriptions of data, probabilities, discrete and continuous random variables, probability distributions, combined distributions, random sampling, parameter estimation, statistical intervals, hypothesis testing, and linear regression. In addition, an experimental design and analysis of measurement data will be discussed. Whereas in the second part explained the concept of stochastic processes, continuous and discrete linear system analysis with the help of the concept of probability and stochastic processes both in the time and frequency domains and the Markov process.

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-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 dan prinsip statistik dan penerapannya untuk analisis dan perancangan pada sistem tenaga listrik, sistem pengaturan, telekomunikasi multimedia, atau elektronika

(CLO-01) Mastering concepts and principles of statistics and their application to analysis and design electric power systems, control systems, multimedia telecommunications, or electronics.

(CPMK-02) Konsep probabilitas, konsep variabel acak , konsep proses acak dalam sistem elektrik, karakteristik sistem LTI baik kontinyu maupun diskrit jika diberi masukan proses acak, serta konsep proses Markov

(CLO-02) Mastering the concept of probability, the concept of random variables, the concept of random processes in electrical systems, the characteristics of the LTI system both continuous and discrete if given random process input, as well as the concept of the Markov process

(CPMK-03) Mampu mendesain eksperimen dengan prinsip statistik dan menganalisa data hasil pengukuran secara statistik.

(CLO-03) Able to design experiments with statistical principles and analyze measurement data statistically.

(CPMK-04) Mampu memodelkan fenomena acak dalam sistem elektrik, melakukan analisis sistem waktu-diskrit dan waktu-kontinyu dengan

bantuan model probabilitas dan stokastik serta mampu menggunakan konsep Markov chain waktu kontinyu maupun diskrit.
(CLO-04) Able to model random phenomena in electrical systems, conduct discrete-time and continuous-time system analysis with the help of probability and stochastic models and be able to use continuous and discrete Markov chain concepts.

(CPMK-05) Mampu menggunakan perangkat lunak, missal: Excel, R, Matlab, dll untuk melakukan analisa statistik dan proses stokastik.
(CLO-05) Able to use software, for example: Excel, Matlab, etc. to perform statistical analysis and stochastic processes.

(CPMK-06) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-06) Demonstrate an attitude of responsibility for work in his area of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Pengantar dan aplikasi statistik di teknik elektro
   Introduction and application of statistics in electrical engineering
2. Representasi statistik deskriptif data dengan teknik numerik dan grafis: histogram, pie chart. Lokasi, sebaran dan variabilitas.
   Descriptive statistical representation of data with numerical and graphical techniques: histograms, pie charts. Location, distribution and variability.
3. Konsep-konsep dasar dari probabilitas, probabilitas bersyarat, variabel acak, distribusi probabilitas, distribusi gabungan.
   Basic concepts of probability, conditional probabilities, random variables, probability distributions, combined distributions.
4. Estimasi parameter, distribusi sampling, dan teorema batas tengah, Interval keyakinan pada parameter untuk satu sampel
   Parameter estimation, sampling distribution, and middle limit theorem, confidence interval for parameters for one sample

5. Uji hipotesa
   Hypothesis test
6. Regresi linier: asumsi model. Metode least-squares
   Linear regression: assumption of the model. The least-squares method
7. Desain eksperimen dan analisa statistik pada permasalahan di teknik elektro
   Experimental design and statistical analysis of problems in electrical engineering
8. Proses Acak
   Random Process
9. Respon Linier Time Invarian (LTI) dengan Input Acak
   Linear Time Invariant (LTI) response with Random Input
10. Markov Chain
    Markov Chain

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] William M. Mendenhall & Terry L. Sincich, “Statistics for Engineering and the Sciences,” 6th ed., CRC Press, 2016.
[2] Jay L. Devore, “Probability and Statistics for Engineering and the Sciences,” 9th ed., Cengage Learning, 2016.
[3] Richard A. Johnson, “Probability and Statistics for Engineers,” 9th ed., Pearson, 2018.

[4] Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, & Keying Ye, “Probability and Statistics for Engineers and Statistics,” 9th ed., Prentice Hall, 2012.
[5] Roy D. Yates & David J. Goodman, “Probability and Stochastic Processes, A Friendly Introduction for Electrical and Computer Engineers”, 3rd ed, John Wiley.

Prasyarat
Prerequisite(s)

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Mata Kuliah ***Course***	Nama MK *Name*	:	Lab. Rangk. Listrik, dan Dasar Sistem dan Jaringan Telekomunikasi *Basic Laboratory of Electricity and Telecommunication Systems*
	Kode MK *Code*	:	EE184406
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	IV (Wajib) *IV (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Hendra Kusuma, M.Eng.
	Pengajar *Lecturer*	:	Dr. Ir. Hendra Kusuma, M.Eng. Dr. Ir. Margo Pujiantara, MT Ir.Gatot Kusrahardjo, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	Requirement and Regulation	*A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-2) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-7) Capable to communicate effectively both in written and oral form

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, dan saling menghormati

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah
Description of Course

Topik/Pokok Bahasan
Main Subjects

Pembelajaran dan ujian
Study and examination

Pustaka
Reference(s)

Prasyarat
Prerequisite(s)

Mata Kuliah ***Course***	Nama MK *Name*	:	Metode Numerik *Numerical Methods*
	Kode MK *Code*	:	EE184004
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	
	Pengajar *Lecturer*	:	
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini bertujuan untuk mengembangkan pemahaman dasar tentang algoritma numerik dan keterampilan untuk menerapkan algoritma numerik untuk memecahkan masalah matematika di komputer. Pada mata kuliah ini, mahasiswa mempelajari tentang bagaimana menyelesaikan suatu permasalahan matematis dengan menggunakan pendekatan algoritma numerik. Topik-topik yang akan dipelajari antara lain galat, representasi bilangan, teorema Taylor, persamaan non-linear, persamaan linear, interpolasi, regresi, integrasi numerik, turunan numerik dan persamaan differensial.

This course is supposed to develop a basic understanding of numerical algorithms and skills for applying numerical algorithms to solve mathematical problems using computer programming. In this course, students learn about how to solve a mathematical problem using a numerical algorithm approach. Topics to be studied include errors, number representations, Taylor theorems, non-linear equations, linear equations, interpolations, regression, numerical integration, numerical derivatives and differential equations.

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-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-9) Capable to learn independently to foster lifelong learning abilities

(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 galat, representasi bilangan, teorema Taylor, persamaan non-linear, persamaan linear, interpolasi, regresi, integrasi numerik, turunan numerik dan persamaan differensial.
(CLO-01) Mastering the concept of error, number representation, Taylor theorem, non-linear equations, linear equations, interpolations, regression, numerical integration, numerical derivatives and differential equations.

(CPMK-02) Mampu menerapkan algoritma numerik untuk melakukan perhitungan galat, menyelesaikan teorema taylor, persamaan non-linear, persamaan linear, interpolasi, regresi, integrasi numerik, turunan numerik dan persamaan differensial.
(CLO-02) Able to apply numerical algorithms to perform error calculations, solve Taylor theorems, nonlinear equations, linear equations, interpolations, regression, numerical integration, numerical derivatives and differential equations.

(CPMK-03) Mampu menerapkan bahasa pemrograman atau tool lain untuk implementasi algoritma numerik.
(CLO-03) Able to apply programming languages or other tools for numerical algorithm implementation.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-04) Demonstrate the attitude of being responsible for work in his area of expertise independently.

(CPMK-05) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-05) Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan
Main Subjects

1. Analisis Galat, representasi bilangan, Teorema Taylor
   Error Analysis, number representation, Taylor Theorem
2. Persamaan non linier
   Non linear equation
3. Persamaan linier
   Linear equation
4. Regresi
   Regression
5. Interpolasi
   Interpolation
6. Integrasi numerik
   Numerical integration
7. Turunan Numerik
   Numeric Derivatives
8. Persamaan Differensial
   Differential Equations

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] Greenbaum and T. P. Chartier. Numerical Methods: Design, Analysis and Computer Implementation of Algorithms. Princeton University Press, 2012.
[2] W. H. Press, S. A. Teukolsky, W. T. Vetterling, B. P. Flannery. Numerical Recipes: The Art of Scientific Computing. Cambridge University Press, 2007.
[3] L. R. Scott. Numerical Analysis. Princeton University Press, 2011.
[4] E. Suli, D. F. Mayers. An Introduction to Numerical Analysis. Cambridge University Press, 2003.

Prasyarat

Prerequisite(s)

- EW184002 Dasar Pemrograman
  EW184002 Basic Programming
- EE184304 Persamaan Differensial Biasa dan Parsial
  EE184304 Partial and Ordinary Differential Equations

Mata Kuliah ***Course***	Nama MK *Name*	:	Rangkaian Analog *Analog Circuits*
	Kode MK *Code*	:	EE184501
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Fajar Budiman, ST, M.Eng
	Pengajar *Lecturer*	:	Dr. Eng Mohammad Attamimi, B. Eng. M. Eng Dr.Ir. Djoko Purwanto, M.Eng Ir. Harris Pirngadi, MT Ir. Tasripan, MT Dr. Ir. Totok Mujiono, MI.Kom. Fajar Budiman, ST, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	Requirement and Regulation	*A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Rangkaian Analog membahas tentang karakteristik rangkaian integrasi penguat operasional, konsep feedback negatif dan positif, rangkaian penguat feedback, komparator, detector level tegangan, hysteresis, rangkaian pembangkit gelombang persegi, segitiga, gigi gergaji, osilator Wien, dan komputer analog, integrator, diferensiator, serta filter aktif Butterworth LPF, HPF, BPF, dan BSF yang diimplementasikan pada penguat operasional.

The Analog Circuit course discusses the characteristics of integrating operational amplifier circuits, feedback and negative feedback concepts, feedback amplifier circuit, comparator, voltage level detector, hysteresis, square wave circuit, triangle, saw-tooth, Wien oscillator and analog computer, integrator, differentiator , as well as active filters of Butterworth LPF, HPF, BPF, and BSF implemented on operational amplifiers.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-3) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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 dan memahami konsep dan prinsip sains alam dan matematika karakteristik penguat operasional serta mahasiswa mampu memahami teori dan konsep penguat feedback negatif, feedback positif, dan komputer analog yang diaplikasikan dengan menggunakan penguat operasional.
(CLO-01) Mastering and understanding the concepts and principles of natural science and mathematical characteristics of operational amplifiers, and students are able to understand theories and concepts of negative feedback amplifiers, positive feedback, and analog computers that are applied using operational amplifiers.

(CPMK-02) Mampu menganalisis dan mendisain rangkaian penguat, pembangkit sinyal, osilator, filter, dan komputer analog pada penguat operasional.
(CLO-02) Able to analyze and design amplifier circuit, signal generator, oscillator, filter, and analog computer on operational amplifier.

(CPMK-03) Mampu menganalisis dan merancang rangkaian analog pada sistem dalam bidang elektro dengan menggunakan penguat operasional.

(CLO-03) Able to analyze and design analog circuits on the system in the field of electrical engineering using operational amplifier.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahlian analisis rangkaian analog khususnya rangkaian penguat operasional secara mandiri.
(CLO-04) Demonstrating attitude of responsibility on his/her work in the field of analog circuit analysis, especially the operational amplifier circuit independently.

Topik/Pokok Bahasan
Main Subjects

1. Karakteristik dasar rangkaian integrasi penguat operasional
   The basic characteristics of integrated operational amplifier circuits
2. Amplifier : Inverting, Non-inverting, adder, buffer, diferensial, dan instrumentasi
   Amplifier: Inverting, Non-inverting, adder, buffer, differential, and instrumentation
3. Komparator : open loop (zero crossing detector), feedback positif (dengan atau tanpa hysteresis)
   Comparator: open loop (zero crossing detector), positive feedback (with or without hysteresis)
4. Signal generator dan osilator Wien
   Signal generator and Wien oscillator
5. Komputer analog (Integrator, differentiator, adder)
   Analog computer (Integrator, differentiator, adder)
6. Filter aktif Butterworth (LPF, HPF, BPF, BSF)
   Active Filter Butterworth (LPF, HPF, BPF, BSF)

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] Diktat Kuliah Rangkaian Analog, Hendra Kusuma 2018
[2] Robert F Coughlin, Frederick F Driscoll, Operational Amplifier and Linear Integrated Circuit, Prentice-Hall International, 2001.
[3] James M. Fiore, Operational Amplifiers & Linear Integrated Circuits: Theory and Application, 2016
[4] Ramakant A Gayakward, Op-Amp dan Linear Integrated Circuits, Prentice-Hall, 2000.

Prasyarat

Prerequisite(s)

EE184306 Rangkaian Elektronika

EE184306 Electronic Circuits

Mata Kuliah ***Course***	Nama MK *Name*	:	Lab. Elka, DST.Listrik & Sis.Pengaturan *Electrical Engineering Laboratory 2*
	Kode MK *Code*	:	EE184502
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Hendra Kusuma, M.Eng.
	Pengajar *Lecturer*	:	Dr. Ir. Hendra Kusuma, M.Eng. Heri Suryoatmojo, ST, MT, PhD Dr.Ir. Ari Santoso, DEA
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini merupakan penerapan teori dasar yang telah dipelajari dalam bentuk eksperimen atau praktikum di laboratorium. Eksperimen tersebut dilakukan di laboratorium untuk melakukan observasi terhadap bidang ilmu sistem tenaga listrik dan sistem pengaturan. Dengan adanya mata kuliah ini, diharapkan pemahaman mahasiswa akan menjadi lebih mendalam serta mengetahui aplikasi dari teori yang ada.

In this course students apply basic theories obtained in classes into hands on or experiments in the laboratory. The experiment is carried out in the laboratory to observe the fields of electric power systems and control systems. Students are expected to have a comprehensive understanding of the theories and its application.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-2) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-7) Capable to communicate effectively both in written and oral form

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, dan saling menghormati

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai pemodelan sistem, analisis sistem pengaturan, menentukan spesifikasi respon, merancang kontroler, serta aplikasinya dalam peralatan, mesin dc, mesin sinkron dan transformator satu fasa.
(CLO-01) Master system modeling, setting system analysis, determining response specifications, designing controllers, and their applications in equipment, dc machines, synchronous machines and single-phase transformers.

(CPMK-02) Mampu memodelkan sistem, menganalisia kestabilan sistem, menentukan spesifikasi respon dan merancang sistem pengaturan, elektronika dan sistem tenaga.
(CLO-02) Able to model systems, analyze system stability, determine response specifications and design control systems, electronics and power systems.

(CPMK-03) Mampu menggunakan software simulasi Matlab atau yang sejenisnya untuk analisis dan visualisasi respon sistem.
(CLO-03) Able to use Matlab or other software to analyze and visualize system responses.

(CPMK-04) Memiliki semangat untuk meningkatkan pengetahuan di bidang teknik elektro demi meningkatkan mutu masyarakat Indonesia dalam penguasaan teknologi.
(CLO-04) Have passion to increase knowledge in the field of electrical engineering in order to improve the quality of the Indonesian people in mastering technology.

Topik/Pokok Bahasan
Main Subjects

1. Pemodelan dan identifikasi sistem serta analisis sistem pengaturan
   System modeling and identification and control system analysis
2. Implementasi sistem pengaturan
   Implementation of control systems
3. Perancangan kontroler dan analisis pengaturan
   Controller design and analysis settings
4. Simulasi sistem pengaturan
   Control system simulation
5. Sistem Otomasi menggunakan PLC
   Automation system using PLC
6. Pemrograman instruksi dasar pada PLC
   Programming basic instructions on the PLC
7. Generator DC
   DC generator
8. Motor DC
   DC motor
9. Generator sinkron 3-fasa
   3-phase synchronous generator
10. Motor asinkron 3-fasa
    3-phase asynchronous motor
11. Transformator 1-fasa
    1-phase transformer

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] Ogata, Katsuhiko: "Modern Control Engineering", 3rd Ed., Prentice-Hall 1997
[2] Jacob, J.M.: "Industrial Control Electronics: Application and Design", PHI 1989
[3] Modul Praktikum Sistem Pengaturan
Control System Practicum Module
[4] Modul Praktikum Dasar Sistem Tenaga Listrik
Basic Electric Power System Practicum Module
[5] Modul Praktikum Elektronika
Electronics Practicum Module

Prasyarat

Prerequisite(s)

- EE184306 Rangkaian Elektronika
  EE184306 Electronic Circuits
- EE184402 Dasar Sistem Tenaga Listrik
  EE184402 Introduction to Power System Engineering
- EE184404 Dasar Sistem Pengaturan
  EE184404 Introduction to Control Systems

1. MK Bidang Keahlian: Teknik Sistem Tenaga

(Specialization Field Course: Power System Engineering)

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

	Requirement and Regulation	*A student must have attended at least 75% of the lectures to sit in the exams*

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 stablitas 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 Publiishing 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

Mata Kuliah ***Course***	Nama MK *Name*	:	Mesin Listrik *Electric Machines*
	Kode MK *Code*	:	EE184512
	Kredit *Credits*	:	4 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 240 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Heri Suryoatmojo, ST, MT, PhD
	Pengajar *Lecturer*	:	Heri Suryoatmojo, ST, MT, PhD Dr. Ir. Soedibyo, MMT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah mesin listrik secara umum membahas tentang prinsip mesin konversi energi listrik. Secara detil, mata kuliah ini menjelaskan tentang prinsip elektromagnetik, konstruksi dan operasional transformator, disain dan perhitungan tegangan yang dibangkitkan dalam mesin listrik berputar. Fitur dan karakteristik mesin sinkron, konstruksi dan analisis motor induksi, konstruksi dan analisis mesin DC.

Electric machine courses generally discuss the principle of electric energy conversion machines. In detail describes the principles of electromagnetic, construction and operational transformer, design and calculation of voltage generated in a rotating electric engine. Features and characteristics of synchronous machines, construction and analysis of induction motors, construction and analysis of DC machines.

CPL Prodi yang Dibebankan

Description of Course

(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-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(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 dasar mesin listrik dan karakteristik mesin listrik.
(CLO-01) Mastering the basic concepts of electrical machinery and electrical machine characteristics.

(CPMK-02) Mampu menganalisis parameter dalam mesin listrik dan mampu menghitung menghitung kebutuhan mesin listrik dalam sistem tenaga.
(CLO-02) Able to analyze the parameters in an electric machine and able to calculate the need of electric machines in the power system.

Topik/Pokok Bahasan

Main Subjects

1. Konsep elektromaknet, dasar mesin elektrik, memahami peranan magnet dalam mesin elektrik, dasar-dasar analisis, tanda-tanda dari variabel mesin.
   The concept of electromagnetism, the basis of electrical machinery, understands the role of magnets in electric machines, the basics of analysis, the signs of machine variables.
2. Konsep dasar, konstruksi dan macam-macam transformator dalam sistem tenaga listrik dan operasionalnya dalam sistem tenaga listrik.
   Basic concepts, constructions and various transformations in electric power systems and their operations in electrical systems.
3. Konsep medan magnet berputar dalam mesin listrik, konstruksi belitan dan proses terbangkitnya tegangan dalam mesin listrik berputar.
   The concept of a rotating magnetic field in an electric machine, winding construction and the process of voltage generation in rotating electrical machine.

4. Konstruksi dan fitur mesin sinkron beserta operasionalnya.
   Construction and synchronous machine features and their operations.
5. Penentuan rangkain ekivalen, parameter dan cara menganalisis mesin sinkron.
   Determination of equivalence circuit, analysis of parameters of synchronous machine.
6. Konstruksi dan operasional mesin induksi
   Construction and operation of induction machines
7. Analisis performansi motor induksi.
   Induction motor performance analysis.
8. Konstruksi mesin dc dan operasionalnya.
   Construction of dc machine and its operation.
9. Karakteristik mesin dc.
   Characteristics of dc machine.

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] J. Chapman, “Electric Machinery Fundamentals”, McGraw-Hill, Inc., New York,St. Louis, San Fransisco, Auckland, Bogotá, Caracas, Hamburg, Lisbon, London, Madrid, Mexico, Milan, Montreal, New Delhi, Paris, San Juan, São Paolo, Singapore, Sydney, Tokyo, Toronto, 1991.

[2] S.K. Sen, "Electrical Machinery" Khanna Publishers, New Delhi,1993.
[3] B.S. Guru & H.R. Hiziroğlu, " Electric Machinery and Transformers" Harcourt Brace Javanovich, Publishers, Technology Publications, San Diego, New York, Chicago, Austin, Washington DC, London, Tokyo, Toronto, 1988.

Prasyarat ***Prerequisite(s)***
EE184402 Introduction to Power System

Mata Kuliah ***Course***	Nama MK *Name*	:	Teknik Tegangan Tinggi *High Voltage Engineering*
	Kode MK *Code*	:	EE184513
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. I Made Yulistya Negara, ST, M.Sc
	Pengajar *Lecturer*	:	Dr. I Made Yulistya Negara, ST, M.Sc Dr. I Gusti Ngurah Satriyadi Hernanda, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata Kuliah Teknik Tegangan Tinggi adalah mata kuliah yang mempelajari dan membahas pembangkitan tegangan tinggi pengujian, karakteritik dan proses kegagalan bahan dielektrik, fenomena petir dan pengamannya. Fenomena tegangan tinggi bisa ditemukan dalam kehidupan sehari-hari. Hampir semua peralatan pembangkit, transmisi atau sistem distribusi menggunakan peralatan tegangan tinggi. Selain itu, pengamanan sistem ketenagalistrikan dari ancaman sambaran petir juga menjadi ilmu yang harus diketahui oleh mahasiswa.

High Voltage Engineering Course is a course that studies and discusses the generation of high-voltage testing, characteristics and the process of dielectric material breakdown, the phenomenon of lightning and its safety. The phenomenon of high voltage could be found in everyday life. Almost all equipment of generating, transmissions or distribution system using high voltage equipment. In addition, the security of the electric power system against the threat of lightning strikes is also a knowledge that must be known by students.

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-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(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 Pembangkitan Tegangan Tinggi (DC, AC, maupun impuls), kegagalan isolasi (gas, padat, cair), terjadinya petir.
(CLO-01) Mastering the concept of High Voltage Generation (DC, AC, or impulse), insulation breakdown (gas, solid, liquid), lightning phenomena.

(CPMK-02) Mampu menggambarkan dan mendeskripsikan modul pembangkitan tegangan tinggi baik DC, AC, maupun impuls.
(CLO-02) Able to draw and describe high voltage generation module in DC, AC, or impulse.

(CPMK-03) Mampu mengambil keputusan terhadap pemilihan komponen modul pembangkitan tegangan tinggi dan koordinasi perlindungan petir.
(CLO-03) Able to take decisions on the selection of high voltage generating module components and coordination of lightning protection.

(CPMK-04) Mampu bertanggung jawab atas hasil kerja, baik secara individu maupun kelompok.
(CLO-04) Be able to take responsibility for the work, either individually or in groups.

Topik/Pokok Bahasan

Main Subjects

1. Perkembangan Tegangan Tinggi
   Development of High Voltage Technology

2. Pembangkitan Tegangan Tinggi DC
   High Voltage DC Generation
3. Pembangkitan Tegangan Tinggi Impuls
   High Voltage Impulse Generation
4. Pembangkitan Tegangan Tinggi AC
   High Voltage AC Generation
5. Kegagalan Isolasi Gas dan Vakum
   Electrical breakdown of vacuum and gas
6. Kegagalan Isolasi Cair dan Padat
   Electrical breakdown of liquid and solid
7. Pengaman Petir
   Lightning Protection

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] I Made Yulistya Negara, Teknik Tegangan Tinggi : Teori dan Aplikasi Praktis, Graha Ilmu, 2013.
[2] Kuffel E., Zaengl W.S., Kuffel J., "High Voltage Engineering: Fundamental", 2nd Edition, Newnes, MA, 2005
[3] Naidu M.S., Kamaraju V., "High Voltage Engineering", 3rd Edition, Mc Graw Hill international Edition, 2004

Prasyarat
Prerequisite(s)

- EW184003 Rangkaian Listrik
  EW184003 Electric Circuit
- EE184303 Medan Elektromagnetik
  EE184303 Electromagnetic Field

Mata Kuliah ***Course***	Nama MK *Name*	:	Elektronika Daya *Power Electronics*
	Kode MK *Code*	:	EE184611
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Heri Suryoatmojo, ST, MT, PhD
	Pengajar *Lecturer*	:	Heri Suryoatmojo, ST, MT, PhD Prof.Dr.Ir. Mochamad Ashari, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia and English
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini memberikan gambaran tentang peran pengkonversian energi berbasis elektronik (elektronika daya) dalam sistem ketenagalistrikan.

This course provides an overview of the role of electronic-based energy (power electronics) conversion in the electricity system.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-3) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(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) Mengetahui aplikasi dan kebutuhan sistem pengkonversi energi berbasis elektronik di lingkup sistem ketenaga-listrikan maupun masyarakat secara umum.
(CLO-01) Knowing the application and requirements of electronic-based energy conversion systems in the scope of electricity systems and society in general.

(CPMK-02) Mengetahui perangkat pengkonversi energi beserta komponen utamanya.
(CLO-02) Knowing the energy conversion device and its main components.

(CPMK-03) Mampu membuat desain sistem pengkonversi energi.
(CLO-03) Able to design energy conversion systems.

(CPMK-04) Mampu membuat analisis teknis terhadap perangkat pengkonversi energi.
(CLO-04) Able to make technical analysis of energy conversion devices.

Topik/Pokok Bahasan
Main Subjects

1. Lingkup sistem ketenaga-listrikan, kebutuhan dan penggunaan perangkat pengkonversi energi
   Scope of the electricity system, needs and use of energy conversion devices
2. Saklar semikonduktor: diode, thyristor, transistor
   Semiconductor switch: diode, thyristor, transistor
3. Rangkaian kombinasi R, L, C dengan saklar dan sumber tegangan DC dan AC
   A series of combinations R, L, C with a switch and a dc and ac voltage source
4. Rangkaian pengkonversi dari :
   - AC ke DC, riak gelombang, filter perata
     AC to DC, wave ripples, level filters

- DC ke DC, riak gelombang
  DC to DC, wave ripples
- DC ke DC, harmonik, filter pasif
  DC to AC, harmonics, passive filters
- DC ke AC, topologi
  AC to AC, topology

5. Sistem uninterruptible power supply, variable speed drive, filter harmonik
   Uninterruptible power supply system, variable speed drive, harmonic filter

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] Mochamad Ashari, “Desain Konverter Elektronika Daya”, Penerbit Informatika, Bandung, 2017
[2] Muhammad H. Rashid, “Power Electronics Handbook Devices, Circuits, and Applications”, Third Edition, 2011
[3] Ned Mohan, “Power Electronics”, John Willey and Sons, 2012

Prasyarat
Prerequisite(s)

- EE184306 Rangkaian Elektronika
  EE184306 Electronic Circuits

- EE184303 Medan Elektromagnetik
  EE184303 Electromagnetic Fields

Mata Kuliah ***Course***	Nama MK *Name*	:	Pembangkitan Tenaga Listrik *Electric Power Generation*
	Kode MK *Code*	:	EE184612
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Soedibyo, MMT
	Pengajar *Lecturer*	:	Dr. Ir. Soedibyo, MMT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata Kuliah Pembangkitan Tenaga Listrik adalah matakuliah yang mempelajari dan membahas proses pembangkitan tenaga listrik berdasarkan energi primernya yakni; pembangkit jenis tidak terbarukan (*non-renewable energy*) maupun pembangkit jenis terbarukan (*renewable energy*). Jenis, prinsip, elemen, dan pengendalian sistem pembangkit berbasis konvensional dan terbarukan dibahas dalam mata kuliah ini. Siswa juga belajar menghitung aspek ekonomi dari sistem pembangkitan seperti biaya pembangkitan dan analisis periode pengembalian modal sederhana.

This course discusses principles of electric energy generation process based on its primary energy. The primary energy resources are conventional fossil fuel-based and renewable. Types, principles, elements, and control of conventional and renewable based generation system are introduced. Students also learn to calculate economic aspects of the generation system such as generation cost and simple payback period analysis.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-3) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan perataruran yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-6) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep Pembangkitan Tenaga Listrik dari berbagai jenis energi primer, baik yang jenis *non-renewable energy* maupun jenis *renewable energy.*
(CLO-01) Mastering the concept of Power Generation from various primary energy types, non-renewable energy and the renewable energy.

(CPMK-02) Mampu dan memahami bagian-bagian dari pembangkit, proses konversi energi, perhitungan kebutuhan bahan bakar atau energi primer serta perhitungan biaya pembangkitan.
(CLO-02) Capable and understand the parts of the plant, the energy conversion process, the calculation of fuel or primary energy requirements as well as the calculation of generation costs.

(CPMK-03) Mampu menentukan; kapasitas pembangkit, kebutuhan bahan bakar bakar tiap hari (dan tiap bulan) serta biaya pembangkitan.
(CLO-03) Able to determine; generating capacity, daily (and monthly) fuel requirements and generating costs.

(CPMK-04) Mampu bertanggung jawab atas hasil kerja, baik secara individu maupun kelompok.

(CLO-04) Able to take responsibility for the work, either individually or in groups.

Topik/Pokok Bahasan

Main Subjects

1. Pembangkit Listrik Tenaga Air
   Hydro Power Generation system
2. Pembangkit Listrik Tenaga Uap (bahan bakar Minyak / Batu Bara)
   Coal-Fired Steam Power Plant
3. Pembangkit Listrik Tenaga Gas (bahan bakar Minyak / Gas Alam)
   Gas-Fired Power Plant
4. Pembangkit Listrik Tenaga Gas – Uap (PLTGU)
   Combined-Cycle Power Plant
5. Pembangkit Tenaga Nuklir
   Nuclear Power Plant
6. Pembangkit Listrik Tenaga Panas Bumi
   Geothermal Power Plant
7. Pembangkit Listrik Tenaga Diesel
   Diesel Engine Power Plant

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] Soedibyo, “PEMBANGKITAN TENAGA LISTRIK - Proses Pembangkitan, Perhitungan Kapasitas, Bahan Bakar serta Biaya

Pembangkitan" Penerbit; ITS Press, ISBN: 978-602-0917-22-1, 2015
[2] Allen J Wood, "Power Generation Operation and Control" 3th edition, 2014
[3] Power Generation from Coal, IEA (International energy agency), 2010
[4] J. Aabakken, Power Technology Energy Databook 3th Edition, 2005

Prasyarat

Prerequisite(s)

EE184402 Dasar Sistem Tenaga Listrik

EE184402 Introduction to Power System

Mata Kuliah ***Course***	Nama MK *Name*	:	Transmisi dan Peralatan Tegangan Tinggi *Transmission and High-Voltage Equipment*
	Kode MK *Code*	:	EE184613
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ardyono Priyadi, ST, M.Eng
	Pengajar *Lecturer*	:	Dr. Ardyono Priyadi, ST, M.Eng Ir. Sjamsjul Anam, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	A student must have attended at least 75% of the lectures to sit in the exams

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Transmisi dan Peralatan Tegangan Tinggi membahas tentang sistem transmisi kelistrikan secara menyeluruh beserta peralatan sistem transmisi termasuk Gardu Induk. Sistem transmisi yang dipelajari secara umum akan dipergunakan untuk mengetahui unjuk kerja dari sistem transmisi panjang, menengah, dan pendek. Parameter unjuk kerja adalah drop tegangan. Perameter mekanis pada sistem transmisi seperti sagging, jenis tower juga dibahas pada mata kuliah ini. Peralatan tegangan tinggi pada sistem transmisi seperti isolator, konduktor, arrester juga dibahas dengan detil.

Transmission and High-Voltage Equipment courses explain the overall electrical transmission system along with transmission system equipment including substations. The transmission system course will be used to determine the performance of long, medium and short transmission systems. Meanwhile, the performance parameter is a voltage drop. Mechanical parameters in transmission systems such as sagging, tower types are also discussed in this course. High voltage equipment in transmission systems such as insulators, conductors, arresters are also discussed in detail.

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-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5)Capable to identify, formulate and solve problems in the field of electrical engineering

(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 dan prinsip sistem transmisi AC , DC dan transmisi bawah tanah dengan segala peralatan tenaga listrik yang melekat pada sistem transmisi.
(CLO-01) Master the concepts and principles of AC, DC transmission and underground transmission with all electrical power equipment attached to the transmission system.

(CPMK-02) Menguasai prinsip kerja peralatan-peralatan tegangan tinggi pada sebuah gardu induk dan prinsip-prinsip desain gardu induk.
(CLO-02)

Master the working principle of high voltage equipment at a substation and the principles of substation design.

(CPMK-03) Mampu menghitung besaran-besaran sistem transmisi seperti resistansi, konduktansi dan impedansi, kapasitansi saluran dan menerapkan pada saluran transmisi pendek, menengah, panjang untuk menghitung unjuk kerja dari saluran transmisi.
(CLO-03) Able to calculate transmission system quantities such as resistance, conductance and impedance, capacitance and apply to short, medium, and long transmission lines to calculate the performance of the transmission line.

(CPMK-04) Mampu menjelaskan konsep saluran tranmsisi HVDC dan saluran Tegangan Tinggi Bawah Tanah dan mampu membandingkan unjuk kerja saluran AC dan DC.
(CLO-04) Able to explain the concept of HVDC transmission lines and Underground High Voltage line and be able to compare the performance of AC and DC line.

(CPMK-05) Mampu menjelaskan dan menggambarkan layout gardu induk serta menjelaskan prinsip kerja dari peralatan gardu induk konvensional maupun Gardu Induk SF_6.
(CLO-05) Able to explain and describe the substation layout and explain the working principles of conventional substation equipment and SF_6 substation.

(CPMK-06) Mampu menggunakan software ETAP atau Power World atau DigSilent untuk menilai unjuk kerja sistem transmisi sederhana.
(CLO-06) Able to use ETAP or Power World or DigSilent software to assess the performance of a simple transmission system.

(CPMK-07) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-07) Showing an attitude of responsibility for work in his area of expertise independently.

(CPMK-08) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-08) Working together to make use of their maximum potential.

Topik/Pokok Bahasan ***Main Subjects***
1. Fungsi, Jenis Transmisi, serta Transmisi AC *Function, Type of Transmission, and AC Transmission*

2. Parameter Saluran: Resistansi
   Parameters: Resistance
3. Parameter Saluran : Induktansi, GMR, GMD
   Parameters: Inductance, GMR, GMD
4. Parameter Saluran : Kapasitansi
   Parameters: Capacitance
5. Pemodelan Saluran : Pendek, Menengah, Panjang
   Channel Modeling: Short, Medium, Long
6. Sistem transmisi HVDC termasuk penggunaan kabel bawah tanah
   HVDC transmission system including the use of underground cables
7. Sag dan Tension, Korona, Bundle Conductor, Transposisi
   Sag and Tension, Korona, Bundle Conductor, Transposition
8. Jenis dan Layout Gardu Induk
   Substation Type and Layout
9. Switchgear : Circuit Breaker, Disconnecting Switch, Trafo Pengukuran (CT & VT)
   Switchgear: Circuit Breaker, Disconnecting Switch, Measurement Transformer (CT & VT)
10. Kabel Daya, Isolator dan Bushing
    Power cables, insulators and bushings

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
Prerequisite(s)

[1] Turan Gonen, “Electrical Power System Transmission Engineering: Anaysis dan Desain”, CRC Press, Third Edition, 2014
[2] J.J. Granger, W.D. Stevenson, ”Power System Analysis”, John Wiley, New York, 1994
[3] –“ ABB Swtichgear Manual”, Cornelsen Verlag, Berlin, 10th revised edition, Berlin, 2004
[4] John D. McDonald (Editor), Electric Power Substations Engineering”, CRC Press, Third Edition, 2012

Prasyarat

Prerequisite(s)

- EE184513 Teknik Tegangan Tinggi
  EE184513 High Voltage Engineering
- EE184511 Analisis Sistem Tenaga Listrik
  EE184511 Power System Analysis

Mata Kuliah ***Course***	Nama MK *Name*	:	Distribusi Tenaga Listrik *Electric Power Distribution*
	Kode MK *Code*	:	EE184614
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Dimas Fajar Uman Putra, ST, MT
	Pengajar *Lecturer*	:	Dr. Dimas Fajar Uman Putra, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata Kuliah Distribusi Tenaga Listrik adalah mata kuliah yang mempelajari dan membahas desain sistem distribusi tenaga listrik baik distribusi primer maupun sekunder, dan permasalahan pada sistem distribusi listrik yang meliputi operasi, stabilitas tegangan, dan rugi - rugi pada sistem tenaga listrik.

Electric Power Distribution discusses basic concepts, design of electric power distribution systems both primary and secondary distribution, and problems in the electricity distribution system that includes operation, voltage stability, and losses in the electric power system.

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-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 desain Distribusi Tenaga Listrik beserta pengenalan peralatan di Gardu Induk dan Jaringan Distribusi Primer maupun Sekunder, menganalisis permasalahan pada system distribusi listrik yang meliputi operasi, stabilitas tegangan, dan rugi-rugi sistem tenaga listrik.
(CLO-01) Mastering the design concept of Electric Power Distribution along with the introduction of equipment in Primary and Secondary Distribution Substations and Networks, analyzing problems in the electricity distribution system which includes operations, voltage stability, and losses of electric power systems.

(CPMK-02) Mampu mengenal peralatan Gardu Induk dan Jaringan Distribusi Primer dan Sekunder dan prinsip kerjanya, mengenalkan prinsip proteksi jaringan distribusi, mengetahui drop tegangan dan rugi-rugi jaringan, memperbaiki power faktor serta menganalisis keandalan sistem distribusi.
(CLO-02) Able to recognize the equipment of Primary and Secondary Distribution Networks and Distribution Working Principles, introduce the principles of distribution network protection, know the voltage drop and network losses, improve power factors and analyze the distribution system reliability.

(CPMK-03) Mampu mengambil keputusan terhadap pemilihan komponen peralatan Gardu induk dan Jaringan Distribusi Tenaga Listrik, merencanakan dan menganalisis sistem distribusi tenaga lsitrik.
(CLO-03) Able to make decisions on the selection of equipment components Substation and Electric Power Distribution Network, plan and analyze the electric power distribution system.

(CPMK-04) Mampu bertanggung jawab atas hasil kerja, baik secara individu maupun kelompok.
(CLO-04) Having responsibility in work, both individually and groups.

Topik/Pokok Bahasan
Main Subjects

1. Review System Tenaga Listrik
   Review of the Electric Power System
2. Jaringan Transmisi
   Transmission Network
3. Gardu Induk Distribusi dan Perlengkapannya
   Distribution Substation and Equipment
4. Jaringan Distribusi Primer dan Sekunder
   Primary and Secondary Distribution Networks
5. Perhitungan Drop tegangan, rugi-rugi jaringan dan power faktor di jaringan
   Calculation of voltage drop, network losses and power factor in the network
6. Proteksi jaringan
   Network protection
7. Keandalan system distribusi
   Reliability of distribution systems

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] Turan Gonen, Electric Power Distribution System Engineering
[2] Westinghouse Electric Corporation, Distribution Systems
[3] Irwin Lazar, Sistem Kelistrikan Industri *(Electrical Systems Analysis and Design for Industrial Plants)*
[4] Electric Power Distribution Handbook, T.A. Short

Prasyarat ***Prerequisite(s)***
- EW184003 Rangkaian Listrik *EW184003 Electrical Circuit* - EE184402 Dasar Sistem Tenaga Listrik *EE184402 Introduction to Power System*

Mata Kuliah ***Course***	Nama MK *Name*	:	Lab. Sistem Tenaga *Power System Laboratory*
	Kode MK *Code*	:	EE184711
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VII (Wajib) *VII (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Heri Suryoatmojo, ST, MT, PhD
	Pengajar *Lecturer*	:	Heri Suryoatmojo, ST, MT, PhD Dr. Rony Seto Wibowo Dr. I Gusti Ngurah Satriyadi
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah lab sistem tenaga merupakan kuliah berbasis laboratorium dimana didalamnya terdapat praktikum: analisis sistem tenaga, mesin arus bolak-balik dan teknik tegangan tinggi.

Power system laboratory is a course based on experiment on laboratories as well as based on software package simulation. This course is comprehensive course which consist of three experiment modules from three laboratories of power system simulation, energy conversion, and high voltage laboratories. Three main experiments will be conducted are electric machines include transformer, dielectric material testing, and power system related to transmission system, protection system, and ETAP software.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan.

(PLO-02) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan.

(PLO-07) Capable to communicate effectively both in written and oral form

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, saling menghormati.

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Mengusai teknik analisis sistem tenaga listrik, mesin arus bolak-balik beserta aplikasinya dan mengetahui teknik pembangkitan tegangan tinggi.

(CLO-01) Mastering on implementation of power system analysis on laboratory scale plant, operation and control of electric machines include transformer, and mastering on high voltage generation for dielectric strength testing.

(CPMK-02) Menguasai analisis data yang diperoleh dari semua modul eksperimen laboratorium dan membandingkan hasil analisis data dengan pengetahuan teorit yang telah dipelajari pada mata pelajaran terkait.

(CLO-02) Mastering on data analysis obtained from all laboratory experiment modules and comparing the data analysis results with theoretical knowledge they have learned on related subjects.

(CPMK-03) Mampu melakukan percobaan skala laboratorium untuk memahami karakteristik mesin listrik Program Sarjana Teknik Elektro dan alat-alat yang dipelajari dengan pengetahuannya.

(CLO-03) Able to conduct laboratory scale experiment to understand the characteristic of electric machines Bachelor Program Electrical Engineering and apparatus being studied by using their background knowledge.

(CPMK-04) Mampu bekerja sama untuk memecahkan masalah yang berkaitan dengan teknik kelistrikan dan bertanggung jawab atas pekerjaannya.

(CLO-04) Able to work as team to solve problem related to electric engineering and be responsible on their work.

Topik/Pokok Bahasan

Main Subjects

1. Performa Pada Saluran Transmisi
   Power system transmission line performance
2. ETAP
   ETAP software package
3. Generator Sinkron 3 Phasa
   3 phase synchronous generator
4. Motor Sinkron 3 Phasa
   3 phase synchronous motor
5. Motor Induksi 3 Phasa Rotor Sangkar
   3 phase induction motor (squirrel cage)
6. Motor Induksi 3 Rotor Gelung
   3 phase induction motor (wave rotor)
7. Transformator 3 Phasa
   3 phase transformer
8. Pengujian Bahan Isolasi Gas
   Dielectric testing (gaseous)
9. Pengujian Bahan Isolasi Padat
   Dielectric testing (solid)
10. Pengujian Bahan Isolasi Cair
    Dielectric testing (liquid)
11. Pengujian Isolator dengan Tegangan AC
    Insulator testing under high voltage ac

Pustaka

Reference(s)

[1] Modul praktikum Analisis Sistem Tenaga
Experimental Module of Power System Analysis
[2] Modul Praktikum Mesin Arus Bolak-Balik
Experimental Module of Alternating Current Electric Machines
[3] Modul Praktikum Tegangan Tinggi
Experimental Module of High Voltage

Prasyarat ***Prerequisite(s)***
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2. MK Bidang Keahlian: Teknik Sistem Pengaturan *(Specialization Field Course: Control System Engineering)*

Mata Kuliah ***Course***	Nama MK *Name*	:	Analisis dan Desain Sistem Pengaturan *Control System Analysis and Design*
	Kode MK *Code*	:	EE184521
	Kredit *Credit*	:	4 sks
	Semester *Semester*	:	IV (Wajib) *IV (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Rusdhianto Effendie AK, MT
	Pengajar *Lecturer*	:	Ir. Rusdhianto Effendie AK, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	Requirement and Regulation	*A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini merupakan kelanjutan dari kuliah Dasar Sistem Pengaturan. Setelah mahasiswa memahami tentang karakteristik respon dalam domain waktu, hal yang penting untuk dipelajari adalah analisis respon dalam domain frekuensi serta teknik pengaturan modern yang menggunakan model matematis sistemnya dalam bentuk *state space*. Oleh karena itu, ruang lingkup yang dipelajari dalam mata kuliah ini adalah teknik menganalisis dan mendasain sistem pengaturan dalam domain frekuensi (menggunakan root locus dan bode diagram) serta dalam bentuk *state space*.

This course is a continuation of the Basic Control System course. After students understand about the response characteristics in the time domain, the important thing to learn is the analysis of responses in the frequency domain as well as the modern control techniques that use the mathematical model of the system in state space. Therefore, the scope studied in this course is the technique of analyzing and designing a regulatory system in frequency domain (using root locus and bode diagram) as well as in state space.

CPL Prodi yang Dibebankan

Learning Outcomes

PENGETAHUAN

KNOWLEDGE

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-04) Mampu bekerja secara efektif dalam kelompok yang beranggotakan lintas disiplin dan budaya dengan menunjukkan sifat kepemimpinan, dan mampu mendefinisikan tujuan, rencana kerja, dan capaian

(PLO-04) Capable to work effectively in groups of members across disciplines and cultures by showing leadership traits, and being able to define goals, work plans, and achievements(

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai teknik analisis dan desain sistem pengaturan pada domain waktu dan frekuensi serta dalam representasi persamaan state.

(CLO-01) Mastering the techniques of analysis and design of control systems in the time domain and frequency as well as in the representation of state equations.

(CPMK-02) Mampu menganalisis dan mendesain sistem pengaturan dengan menggunakan root locus, bode diagram, diagram nyiquist serta dalam bentuk state space.

(CLO-02) Able to analyze and designing control system by using root locus, bode diagram, nyiquist diagram and in state space.

(CPMK-03) Mampu mensimulasikan hasil desain sistem pengaturan menggunakan software simulasi.

(CLO-03) Able to simulate the design result of the system using simulation software.

(CPMK-04) Memiliki semangat untuk meningkatkan pengetahuan di bidang sistem pengaturan demi meningkatkan mutu masyarakat Indonesia dalam penguasaan teknologi.

(CLO-04) Have a passion to improve knowledge in the field of control system to improve the quality of Indonesian society in the mastery of technology.

Topik/Pokok Bahasan

Main Subjects

1. Analisis kestabilan sistem menggunakan metode Root Locus
   System stability analysis using Root Locus method
2. Analisis kestabilan domain frekuensi menggunakan metode diagram Bode dan diagram Nyquist
   Stability analysis of frequency domain using Bode diagram method and Nyquist diagram
3. Perancangan kompensator berbasis Root Locus
   Design of Root Locus based compensator
4. Perancangan kompensator berbasis Bode Diagram
   Design of Bode Diagram based compensator
5. Representasi sistem dalam bentuk persamaan state
   Representation of the system in the form of state equations
6. Bentuk kanonik persamaan state dan transformasinya
   The canonical form of state equations and their transformations
7. Sifat-sifat intrinsik persamaan state (controllability & observability)
   The intrinsic properties of state equations (controllability & observability)
8. Analisis kestabilan sistem dalam bentuk persamaan state
   Analysis of system stability in the form of state equations

9. Desain kontroler state feedback
   Design of state feedback controller
10. Proses Decoupling sistem MIMO menggunakan aljabar diagram blok dan state feedback
    Decoupling process of MIMO system using algebra block diagram and state feedback
11. Desain sistem Cascade
    Cascade system design
12. Desain kontroler berbasis error model: Sliding Mode, Invers error model
    Design of error-based model controller: Sliding Mode, Inverse error model

Pustaka

Reference(s)

[1] Ogata, Katsuhiko, "Modern Control Engineering", 5 edition, Pearson, 2009.
[2] Kuo, C. Benjamin. "Automatic Control System", Wiley, 2002.
[3] Franklin, F. Gene, Powell, J. David, Naeini, Abbas Emami. "Feedback Control of Dynamic System", 6th edition
[4] Nise, Norman S., "Control System Engineering". Wiley. 2015

Prasyarat

Prerequisite(s)

EE184404 Dasar Sistem Pengaturan

EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Otomasi Sistem *System Automation*
	Kode MK *Code*	:	EE184522
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Eka Iskandar, ST, MT
	Pengajar *Lecturer*	:	Eka Iskandar, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini memberikan pemahaman kepada peserta mata kuliah tentang bentuk-bentuk aplikasi sistem otomasi di industri, macam-macam sistem otomasi, prinsip-prinsip pengendalian dan berbagai metode perancangan ladder di bidang otomasi, dan teknologi instrumentasi dan pengendalian proses.

This course provides an understanding to the course participants about the forms of automation system application in the industry, various automation systems, control principles and various design methods of ladder in the field of automation, and instrumentation technology and process control.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah
Course Learning Outcomes

(CPMK-01) Menguasai konsep dan prinsip sistem otomasi di industri.

(CLO-01) Mastering the concepts and principles of engineering and make it happen in the form of procedures necessary for the analysis and design of electric power systems, regulatory systems, multimedia telecommunications, or electronics

(CPMK-02) Mampu menganalisis dan merancang sistem otomasi di industry

(CLO-02) Able to analyze and design automation systems in the industry

(CPMK-03) Mampu memberikan konsultasi tentang desain dan pengembangan sistem otomasi di industry

(CLO-03) Able to provide consultation on design and development of industrial automation system

(CPMK-04) Mampu menerapkan berbagai metode perancangan ladder diagram ke peralatan Programmable Logix Controller (PLC)

(CLO-04) Able to apply various design method of ladder diagram to Programmable Logix Controller (PLC) equipment

(CPMK-05) Mampu menerapkan produk – produk teknologi sistem dan pengaturan lainnya

(CLO-05) Ability to apply products technology in system and control other

(CPMK-06) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri

(CLO-06) Show a responsible attitude towards the work in the field of expertise independently

Topik/Pokok Bahasan
Main Subjects

1. Konsep otomasi sistem
   The concept of system automation
2. Peralatan otomasi sistem
   System automation equipment
3. Perancangan diagram ladder berdasar sequence chart
   Design of ladder diagram based on sequence chart
4. Perancangan diagram ladder berdasar metode cascade
   Design of ladder diagram based on cascade method
5. Perancangan diagram ladder berdasar Grafchet
   Design of ladder diagram based on Grafchet
6. Perancangan diagram ladder berdasar state diagram
   Design of ladder diagram based on State diagram
7. Perancangan diagram ladder berdasar metode huffman
   Design of ladder diagram based on Huffman method
8. Perancangan diagram ladder berdasar Petri-Net
   Design of ladder diagram based on Petri-net

Pustaka
Reference(s)

[1] D. Pessen, Industrial Automation, Wiley, 1989
[2] S. Baranov, Logic Synthesis for Control Automata, Kluwer Academic Publisher, 1994
[3] Applying Structured Analysis To Automation Systems (Paper 1)
[4] The Principles of State Logic Control (Paper 2)
[5] Tadao Murata, Petri Nets: Properties, Analysis and Applications, Proceedings of the IEEE, vol.77, no 4, April 1989 (paper 3)

Prasyarat
Prerequisite(s)

EE184404 Dasar Sistem Pengaturan
EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Teknik Optimisasi *Optimization Techniques*
	Kode MK *Code*	:	EE184523
	Kredit *Credit*	:	4 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Zulkifli Hidayat, ST, M.Sc
	Pengajar *Lecturer*	:	Zulkifli Hidayat, ST, M.Sc
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata Kuliah Penyelidikan Operasi membahas tentang konsep optimasi, dasar - dasar matematika optimasi, penyelesaian analitis untuk persoalan optimasi, penyelesaian numerik untuk persoalan optimasi tanpa kendala, pemrograman linier dan variasinya, pemrograman dinamik baik yang deterministik maupun stokastik, dan meteode metaheuristik.

Optimization Techniques course discusses optimization concept, optimization mathematical basic, analytical solution for optimization problems, Numerical solution for unconstraint optimization problem, Linear programming and its variants, deterministic or stochastic dynamic programming, and metaheuristic methods.

CPL Prodi yang Dibebankan

Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 optimasi dan berbagai macam bentuk persoalan optimasi beserta metode penyelesaiannya.

(CLO-01) Mastering the concept of optimization and various forms of optimization issues and methods of completion.

(CPMK-02) Mampu mendapatkan model matematika persoalan optimasi dan menyelesaikan berbagai macam persoalan optimasi dengan menggunakan pendekatan analitik, pendekatan numerik, maupun pendekatan matrik maupun metode metaheuristik.

(CLO-02) Able to get mathematical model of optimization problem and solve various optimization problems by using analytical approach, numerical approach, matrix approach and metaheuristic method.

(CPMK-02) Mampu menggunakan software Matlab, Delphi dan Visual C untuk menyelesaikan persoalan optimasi.

(CLO-02) Able to use Matlab, Delphi and Visual C software to solve optimization problems.

(CPMK-03) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-03) Demonstrate a responsible attitude towards the work in the field of expertise independently.

Topik/Pokok Bahasan

Main Subjects

1. Konsep Optimasi
   Optimization Concepts
2. Dasar – Dasar Matematika Optimasi
   Basic - Basic Mathematics Optimization
3. Penyelesaian Numerik Persoalan Optimasi
   Numerical Solutions Optimization Problems
4. Pemrograman Linier
   Linear Programming

5. Variasi Pemrograman Linier
   Linear Programming Variations
6. Pemrograman Dinamik Deterministik
   Dynamic Deterministic Programming
7. Pemrograman Dinamik Stokastik
   Stochastic Dinamic Programming
8. Studi Kasus
   Case Studies
9. Metode Metaheuristik
   Metaheuristic Method

Pustaka

Reference(s)

[1] Alkaff, A. dan Gamayanti, N. Diktat Kuliah Penyelidikan Operasi
[2] Analisis Hillier and Lieberman., “Introduction to Operation Research”, 8th Edition, Mc Graw Hill international Edition, 2004
[3] Hamdy A taha., “Operation Research : an Introduction”, 8th Edition, Prentice Hall, 2006
[4] WAGNER, H.M., "Principles of Operations Research”, 2nd edition", Prentice-Hall, New Jersey 1980.

Prasyarat

Prerequisite(s)

EE184304 Persamaan Differensial Biasa dan Parsial

EE184304 Ordinary and Partial Differential Equations

Mata Kuliah ***Course***	Nama MK *Name*	:	Instrumentasi Sistem Pengaturan *Instrumentation System Control*
	Kode MK *Code*	:	EE184621
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VI (Wajb) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Eka Iskandar, ST, MT
	Pengajar *Lecturer*	:	Eka Iskandar, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini membahas tentang konsep penerapan sistem instrumentasi terkait pengukuran, variabel proses, transduser, pemilihan sensor, karakteristik dalam pengaplikasian berbagai macam sensor (mekanik, optik, thermal, lainnya), rangkaian pengkondisi sinyal konverter.

This course discusses the concept of implementing an instrumentation system related to measurement, process variables, transducers, sensor selection, characteristics in the application of various sensors (mechanical, optical, thermal, etc.), signal converter conditioning circuits.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental

(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) Mampu merancang sistem pengaturan beserta instrumentasi yang diperlukan sehingga objektif kontrol terpenuhi

(CLO-01) Able to design the regulatory system along with the necessary instrumentation so that control objectives are met

(CPMK-02) Mampu membuat diagram sistem pengaturan dalam diagram fisik, blok dan instrumentasi (P&ID)

(CLO-02) Able to create system arrangement diagrams in physical, block and instrumentation (P&ID) diagrams

Topik/Pokok Bahasan

Main Subjects

1. Introduksi intrumentasi dan sistem pengaturan
   Introduction of instrumentation and regulatory systems
2. Pengkondisian sinyal analog
   Analog signal conditioning
3. Pengkondisian sinyal digital
   Digital signal conditioning
4. Sensor temperature
   Temperature sensor
5. Sensor level, pressure, weight dan flow
   Level, pressure, weight and flow sensors
6. Elemen kontrol akhir
   The final control element
7. Komputer dalam sistem pengaturan
   Computer in system setting
8. Sistem komunikasi pengaturan proses
   Process management communication system

Pustaka

Reference(s)

[1] Curtis D. Jonhson., “Process control instrumentation technology,” 7th edition, PHI, New Jersey, 1989

[2] Wolfgang Altmann, “Practical Process Control for Engineers and Technicians,” John Elsevier, 2005
[3] W.L. Luyben, “Process Modeling, Simulation and Control for Chemical Engineers,” McGraw Hill, 2nd edition, 1990
[4] Karl J. Astrom, and Bjorn Wittenmark, “Computer-controlled systems: theory and design,” 3rd edition, PHI, New Jersey, 1997.

Prasyarat
Prerequisite(s)

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Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Pengaturan Digital *Digital Control Systems*
	Kode MK *Code*	:	EE184622
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	M. Abdul Hady, ST, MT
	Pengajar *Lecturer*	:	M. Abdul Hady, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini mempelajari konsep sistem pengaturan yang menggunakan kontroler digital (perangkatnya bekerja secara digital). Saat ini perangkat elektronika hampir seluruhnya berbasiskan sistem digital, sehingga semua sinyal yang diproses dalam kontroler dilakukan secara digital. Dalam mata kuliah ini hal yang dipelajari yaitu: analisis sistem pengaturan dalam domain waktu diskrit hingga desain kontrolernya.

In this course the concept of control systems that use digital controllers (microprocessors or computers) is studied. Currently electronic devices are almost entirely based on digital systems, so all the signals processed in the controller are done digitally. In this course: analysis of control system in discrete time domain followed by controller design.

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-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 sistem pengaturan digital mulai dari analisis sistem hingga mendesai kontrolernya.

(CLO-01) Mastering the concept of digital control systems ranging from systems analysis to designing the controller.

(CPMK-02) Mampu menganalisis dan mendesain sistem pengaturan digital.

(CLO-02) Able to analyze and design digital control systems.

(CPMK-03) Menguasai konsep sinyal digital serta mampu merepresentasikan sistem pengaturan digital dalam software Matlab

(CLO-03) Mastering the concept of digital signals as well as to represent a digital control system in Matlab

(CPMK-04) Mampu menyelesaikan tugas-tugas mandiri dan kelompok dengan bekerja sama positif

(CLO-04) Able to complete independent tasks and groups by working together positively

Topik/Pokok Bahasan

Main Subjects

1. Konsep sistem pengaturan digital
   The concept of digital control system
2. Konversi dan rekonstruksi sinyal
   Conversion and signal reconstruction
3. Analisis domain waktu pada sistem waktu diskrit
   Time domain analysis on discrete time systems
4. Analisis domain frekuensi pada sistem waktu diskrit
   Frequency domain analysis on discrete time systems
5. Perancangan kontroler digital
   Design of digital controllers

Pustaka

Reference(s)

[1] Charles L. Phillips and H. Troy Nagle. Digital Control System Analysis and Design, third edition, Prentice Hall, 1995.
[2] K. Ogata, Discrete-Time Control Systems, Second Edition, Englewood Cliffs, NJ: Prentice Hall, 1995, ISBN: 0-13-034281-5.

Prasyarat

Prerequisite(s)

- EE184521Analisis dan Desain Sistem Pengaturan
  EE184521 Control System Analysis and Design

Mata Kuliah ***Course***	Nama MK *Name*	:	Komputasi Sistem Linier *Linear System Computation*
	Kode MK *Code*	:	EE184623
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Mochammad Sahal, ST, M.Sc
	Pengajar *Lecturer*	:	Mochammad Sahal, ST, M.Sc
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Komputasi Sistem Linear membahas tentang Euclidean dan Generalisasi Ruang Vektor, Matrik dan Determinan, Ruang Hasil Kali Dalam, Eigenvalue dan Eigenvektor, Konvolusi Integral dan Konvolusi Jumlah, Penyelesaian sistem Persamaan Diferensial dan Persamaan Beda, Kontrolabilitas dan Observabilitas, Stabilitas.

The Linear System Computation course deals with computational techniques of linear system analysis methods in state space representations. The first part of this lecture contains matrix computations used in the representation of the state space model. Furthermore, presented computational techniques to perform simulation and operation on the linear system. At the end, described the methods of linear system analysis used to determine the behavior of the system.

CPL Prodi yang Dibebankan

Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 fakta, konsep, prosedur, dan prinsip komputasi aljabar linear dan sistem linear.

(CLO-01) Mastering the facts, concepts, procedures, and computational principles of linear algebra courses and linear systems.

(CPMK-02) Menguasai strategi merancang program komputer untuk aljabar linear dan sistem linear secara numerik.

(CLO-02) Mastering the strategy of designing computer programs for linear algebra and linear systems numerically.

(CPMK-03) Mampu menggunakan software Matlab/Simulink untuk melakukan simulasi dan eksperimentasi konsep aljabar linear dan sistem pengaturan linear.

(CLO-03) Able to use Matlab / Simulink software to simulate and experiment the concept of linear algebra and linear control system.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrate a responsible attitude towards the work in the field of expertise independently.

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

(CLO-05) Working together to be able to take full advantage of their potential.

Topik/Pokok Bahasan

Main Subjects

1. Euclidean dan Generalisasi Ruang Vektor
   Euclidean and Generalization of Vector Space
2. Matrik dan Determinan

Matrix and Determinant
3. Ruang Hasil Kali Dalam
   Inner Products Space
4. Eigenvalue dan Eigenvektor
   Eigenvalue and Eigenvektor
5. Konvolusi Integral dan Jumlah
   Integral and Sum Convolution
6. Penyelesaian PD dan PB
   Differential and Difference Equation Solutions
7. Kontrolabilitas dan Observabilitas
   Controllability and Observability
8. Stabilitas
   Stability

Pustaka

Reference(s)

[1] Howard Anton and Chris Rorres, "Elementary Linear Algebra," 11th Edition, John Wiley & Sons, New York, 2014
[2] Biswa Nath Datta, "Numerical Methods for Linear Control Systems", Elsevier, California, 2004
[3] Steven C. Chapra, "Applied Numerical Methods with MatLab", 4th Edition, McGraw-Hill, 2017

Prasyarat

Prerequisite(s)

EE184201 Aljabar Linear dan Struktur Diskrit

EE184201 Linear Algebra and Discrete Structure

Mata Kuliah ***Course***	Nama MK *Name*	:	Lab. Pengaturan Digital dan Otomasi *Digital Control and Automation Laboratory*
	Kode MK *Code*	:	EE184721
	Kredit *Credit*	:	2 sks
	Semester *Semester*	:	VII (Wajib) *VII (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 2 x 50 = 100 menit/minggu Latihan/tugas : 2 x 60 = 120 menit/minggu Belajar mandiri : 2 x 60 = 120 menit/minggu *Lectures : 2 x 50 = 100 min/week* *Exercises/Assignments : 2 x 60 = 120 min/week* *Self learning : 2 x 60 = 120 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr.Ir. Ari Santoso, DEA
	Pengajar *Lecturer*	:	Dr.Ir. Ari Santoso, DEA Yusuf Bilfaqih, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini memberikan pemahaman kepada peserta mata kuliah tentang bentuk-bentuk pemrograman kontroler digital dan aplikasi teknik otomasi di industri, macam-macam metode teknik pemrograman kontroler digital & bidang otomasi di industri, prinsip-prinsip pengendalian kontrol digital & otomasi dan berbagai metode perancangan ladder di bidang otomasi, dan teknologi instrumentasi dan pengendalian proses.

These laboratory works provides practical understanding to the students about the forms of digital controller programming and the application of automation techniques in the industry, various digital programming & automation techniques in the industry, the principles of digital control & automation and various methods of ladder design in the field of automation, and instrumentation technology and process control.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-02) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-07) Capable to communicate effectively both in written and oral form

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, saling menghormati.

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep dan prinsip kontrol digital.

(CLO-01)Mastering the concepts and principles of Digital Control

(CPMK-02) Menguasai konsep dan prinsip sistem otomasi di industri.

(CLO-02) Mastering the concepts and principles of Automation System in Industry

(CPMK-03) Mampu menganalisis dan merancang kontrol digital.

(CLO-03) Able to analyze and design Digital Control

(CPMK-04) Mampu menganalisis dan merancang sistem otomasi di industri.

(CLO-04) Able to analyze and design Automation System in Industry

(CPMK-05) Mampu memberikan konsultasi tentang desain dan pengembangan kontrol digital dan sistem otomasi di industri.

(CLO-05) Able to provide consultation on the design and development of digital control and automation systems in the industry

(CPMK-06) Mampu menerapkan berbagai kontroler digital.

(CLO-06) Able to apply various digital controllers

(CPMK-07) Mampu menerapkan berbagai metode perancangan ladder diagram ke peralatan Programmable Logix Controller (PLC).

(CLO-07) Able to apply various design method of ladder diagram to Programmable Logix Controller (PLC) equipment

(CPMK-08) Mampu menerapkan produk - produk teknologi sistem dan pengaturan lainnya.

(CLO-08) Able to apply system technology products and other settings

(CPMK-09) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-09)Showing a responsible attitude towards the work in the field of expertise independently.

Topik/Pokok Bahasan

Main Subjects

1. Praktikum sampling dan rekontruksi sinyal
   Practice on Sampling and Signal Reconstruction
2. Praktikum penyaringan sinyal dengan filter digital
   Practice on Filtering Signals with Digital Filters
3. Praktikum pemrograman kontrol digital untuk mikrokontroler pada sistem pengaturan kecepatan motor DC
   Practice on digital control programming for microcontroller on DC motor speed regulation system
4. Praktikum pemrograman kontrol digital untuk PC pada sistem pengaturan kecepatan motor DC
   Practice on digital control programming forPC on DC motor speed control system
5. Praktikum pemrograman diagram ladder berdasar sequence chart pada PLC
   Practice on ladder diagram programming based on sequence chart on PLC
6. Praktikum pemrograman diagram ladder berdasar metode cascade pada PLC
   Practice on ladder diagram programming based on cascade method on PLC

7. Praktikum pemrograman diagram ladder berdasar Grafchet pada PLC
   Practice on ladder diagram programming based on Grafchet on PLC
8. Praktikum pemrograman diagram ladder berdasar state diagram pada PLC
   Practice on ladder diagram programming based on state diagram on PLC
9. Praktikum pemrograman diagram ladder berdasar metode huffman pada PLC
   Practice on ladder diagram programming based on Huffman method on PLC
10. Praktikum pemrograman diagram ladder berdasar Petri-Net pada PLC
    Practice on ladder diagram programming based on Petri-Net on PLC

Pustaka

Reference(s)

[1] D. Pessen, Industrial Automation, Wiley, 1989
[2] S. Baranov, Logic Synthesis for Control Automata, Kluwer Academic Publisher, 1994
[3] Applying Structured Analysis To Automation Systems (Paper 1)
[4] The Principles of State Logic Control (Paper 2)
[5] Tadao Murata, Petri Nets: Properties, Analysis and Applications, Proceedings of the IEEE, vol.77, no 4, April 1989 (paper 3)

Prasyarat

Prerequisite(s)

- EE184622 Dasar Sistem Pengaturan
  EE184622 Digital Control Systems
- EE184522 Otomasi Sistem
  EE184522 System Automation

Mata Kuliah ***Course***	Nama MK *Name*	:	Perancangan dan Integrasi Sistem *System Design and Integration*
	Kode MK *Code*	:	EE184722
	Kredit *Credit*	:	4 sks
	Semester *Semester*	:	VII (Wajib) *VII (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Yusuf Bilfaqih, ST, MT
	Pengajar *Lecturer*	:	Yusuf Bilfaqih, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini membahas tentang perancangan suatu sistem dengan mempertimbangkan beberapa aspek, mengevaluasi suatu hasil rancangan dari beberapa macam aspek, membandingkan beberapa hasil rancangan, menentukan rancangan yang terbaik dari kesemuanya, dan mengintegrasikan rancangan yang terpilih dalam bentuk arsitektur teknologi yang uniform. Selanjutnya, mengimplementasikan arsitektur teknologi tersebut ke dalam bentuk produk teknologi yang menjawab kebutuhan.

This course discusses the design of a system by considering several aspects, evaluating a design result from several aspects, comparing several design results, determining the best design of all, and integrating the designs chosen in the form of uniform technological architecture. Next, implementing the technology architecture into the form of technology products that fulfill the needs.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(KK03) Capable to identify, formulate and solve problems in the field of electrical engineering

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

(KU05) Capable to know and respond to the latest developments in science and technology by promoting universal values

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Konsep dan metodologi perancangan dan integrasi sistem

(CLO-01) Mastering of the concept and methodology of system design and integration.

(CPMK-02) Mampu mengintegrasikan hasil rancangan suatu sistem dengan memadukan teknologi, aplikasi, data dan komunikasi ke dalam satu struktur kerja fungsional dengan bentuk arsitektur teknologi yang uniform.

(CLO-02) Able to integrate the design result of a system by combining technology, application, data and communication into a functional work structure with uniform technological architecture form.

(CPMK-03) Mampu mengambil keputusan secara tepat dalam konteks penyelesaian masalah di bidang keahliannya, berdasarkan hasil analisis informasi dan data.

(CLO-03) Able to make decisions appropriately in the context of problem solving in the area of expertise, based on the results of information and data analysis.

(CPMK-04) Berkontribusi dalam peningkatan mutu kehidupan bermasyarakat, berbangsa, bernegara, dan peradaban berdasarkan Pancasila.

(CLO-04) Contributing to improving the quality of life of society, nation, state, and civilization based on Pancasila.

Topik/Pokok Bahasan

Main Subjects

1. Metodologi Perancangan Sistem
   System Design Methodology
2. Studi Kebutuhan Sistem
   System Requirement Study
3. Perancangan Konseptual
   Conceptual Design
4. Perancangan Fungsional
   Functional Design
5. Perancangan Detail
   Detailed Design
6. Pengujian Sistem
   System Testing
7. Pendukung Keputusan Rancangan Sistem
   Decision Support System Design
8. Integrasi Sistem
   System Integration
9. Komponen Integrasi Sistem
   System Integration Components
10. Implementasi Sistem
    System Implementation

Pustaka

Reference(s)

1. Wasson, Charles S. System Analysis, Design, and Development: Concepts, Principles, and Practices. John Wiley & Sons, New Jersey, 2006
2. Blanchard, B.S., W.J. Fabrycky. Systems Engineering and Analysis. 2nd edition, Prentice-Hall, New Jersey, 1992..
3. Juric, Matjaz B., Ramesh Loganathan, Poornachandra Sarang, & Frank Jennings. SOA Approach to Integration. Packt Publishing, Birmingham, 2007

4. Ruh, William A., Francis X. Maginnis, & William J. Brown. Enterprise Application Integration. John Wiley & Sons, Inc., 2001
5. Myerson, Judith M. Enterprise Systems Integration. CRC Press Company, 2002.
6. Miller, Thomas E., Daryle W. Berger. Totally Integrated Enterprises. Raytheon Professional Services LLC, 2001.

Prasyarat ***Prerequisite(s)***
Passing 110 credits

3. MK Bidang Keahlian: Telekomunikasi Multimedia *(Specialization Field Course: Multimedia Telecommunications)*

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Komunikasi I *Communication Systems 1*
	Kode MK *Code*	:	EE184531
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Titiek Suryani, MT
	Pengajar *Lecturer*	:	Dr. Ir. Titiek Suryani, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	Requirement and Regulation	*A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Sistem Komunikasi I membahas tentang Transmisi dan pertukaran informasi menggunakan sinyal listrik dan gelombang elektromagnetik. Mempelajari teknik modulasi analog meliputi modulasi amplitudo, modulasi sudut dan modulasi digital biner, konsep demodulasi menggunakan teknik demodulasi koheren dan filtering serta deteksi selubung untuk memperoleh informasi kembali. Konsep perhitungan kinerja sistem komunikasi analog dan digital dalam pengaruh derau.

The course of Communication system 1 discusses transmission and exchange of information uses electrical signals and electromagnetic waves. Learning analog modulation techniques including amplitude modulation, angular modulation and binary-digital modulation, the concept of demodulation uses coherent demodulation and filtering techniques and shell detection to obtain information again. The concept of calculating the performance of analog and digital communication systems in the effects of noise.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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 transmisi sinyal pesan baik secara analog dan digital biner. Menguasai teknik pencampuran frekuensi, teknik filtering, dan teknik modulasi untuk transmisi sinyal pesan secara analog dan digital biner. Menguasai teknik-teknik demodulasi dan deteksi optimum untuk memperoleh kembali sinyal pesan dari sinyal transmisi yang terganggu derau putih Gaussian. Menguasai metode evaluasi kinerja sistem komunikasi analog dan digital.

(CLO-01) Mastering the concept of message signal transmission both in analog and binary digital. Mastering frequency mixing techniques, filtering techniques, and modulation techniques for transmitting message signals in analog and binary digital. Mastering demodulation and optimum detection techniques to recover message signals from transmission signals that are disturbed by white Gaussian noise. Mastering the methods of performance evaluation of analog and digital communication systems.

(CPMK-02) Mampu menganalisis teknik transmisi sinyal pesan analog dan digital biner dan mampu mengevaluasi kinerja sistem komunikasi analog dan digital biner yang terkena gangguan derau.

(CLO-02) Able to analyze analog and digital message signal transmission techniques and be able to evaluate the performance of binary analog and digital communication systems that are affected by noise.

(CPMK-03) Mampu menggunakan software Matlab/Simulink untuk melakukan visualisasi dan eksperimentasi konsep transmisi sinyal pesan secara analog dan digital biner melalui kanal dengan gangguan derau.

(CLO-03) Able to use Matlab / Simulink software to visualize and experimentation the concept of transmitting message signals in analog and binary digital through channel with noise.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

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

(CLO-05) Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan

Main Subjects

1. Konsep Sinyal dan Spektrum Sinyal komunikasi.
   Concepts of Signals and Spectrum of Communication Signals.
2. Konsep transmisi ideal, filtering kuadratur dan transformasi Hilbert.
   The ideal transmission concept, quadrature filtering and Hilbert transformation.
3. Konsep Modulasi Amplitudo.
   Concept of Amplitude Modulation.
4. Konsep Modulasi Sudut.
   Concept of Angular Modulation.
5. Konsep Modulasi Pulsa: transisi dari komunikasi analog ke komunikasi digital.

Concept of Pulse Modulation: the transition from analog communication to digital communication.

6. Konsep Trasmisi Digital Base-band.
   Concept of Base-band Digital Transmission.
7. Konsep Modulasi Band-pass Digital.
   Digital Band-pass Modulation Concept.
8. Derau dalam Sistem Komunikasi Analog.
   Noise in Analog Communication Systems
9. Derau dalam Sistem Komunikasi Digital.
   Noise in Digital Communication Systems.

Pustaka

Reference(s)

[1] Simon Haykin and Michael Moher, Introduction to Analog and Digital Communications, John Wiley and Sons, 2007.
[2] Hwei Hsu, Ph.D., Schaum's outline of theory and problems of Analog and Digital Communications, 2nd , Mc-Graw Hill, 2003.
[3] Leon W. Couch, II, Digital and analog communication systems, 8th Edition,Prentice Hall, 2016.
[4] Grahame Smillie, Analogue and Digital Communication Techniques, Butterworth-Heinemann, 1999.
[5] Michel C. Jeruchim, Philip Balaban, and K. Sam Shanmugan. Simulation of communication systems: modeling, methodology and techniques. Springer Science & Business Media, 2006.

Prasyarat

Prerequisite(s)

- EE184305 Sinyal dan Sistem
  EE184305 Signals and Systems
- EE184405 Probabilitas, Statistik dan Proses Stokastik
  EE184405 Probabilitas, Statistics, and Stochastic Processes

Mata Kuliah ***Course***	Nama MK *Name*	:	Transmisi Gelombang Elektromagnetik dan Antena *Electromagnetic Wave Transmission and Antenna*
	Kode MK *Code*	:	EE184532
	Kredit *Credit*	:	4 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Achmad Mauludiyanto, MT
	Pengajar *Lecturer*	:	Dr. Ir. Achmad Mauludiyanto, MT Dr. Ir. Puji Handayani, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Transmisi Gelombang Elektromagnetik dan Antena mempelajari Saluran Transmisi tanpa-rugi dan saluran merugi, Propagasi gelombang bidang dalam media tanpa-rugi dan media merugi, Pantulan dan tranmisi gelombang dengan kedatangan normal dan kedatngan menyudut, konsep radiasi antenna melalui Integral radiasi pada antenna dipole ideal, Parameter antena : pola radiasi, directivity, gain,bandwidth, effective aperture,polarisasi, Antena kawat, Antena pita lebar, Antena array, dan Teknik pengukuran antena.

The course studies the no-loss and loss-line transmission lines, field wave propagation in no-loss media and loss media, wave reflection and transmission with normal arrival and angles, the concept of radiation antenna through the integral radiation at the ideal dipole antenna, antenna parameters: pattern radiation, directivity, gain, bandwidth, effective aperture, polarization, wire antenna, wide band antenna, array antenna, and antenna measurement technique.

CPL Prodi yang Dibebankan

Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by

considering safety, social, cultural, environmental and economic aspects

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep Transmisi Gelombang Elektromagnetik.

(CLO-01) Mastering the concept of Electromagnetic Wave Transmission.

(CPMK-02) Menguasai konsep radiasi dari suatu antena, parameter-parameter antena, pengukuran antena dan jenis-jenis yang umum digunakan: antena kawat, antena pita lebar, antena aperture, dan antena array.

(CLO-02) Mastering the concept of radiation from an antenna, antenna parameters, antenna measurements and commonly used types: wire antenna, broadband antenna, aperture antenna, and antenna array.

(CPMK-03) Mampu menganalisis persamaan gelombang dan turunannya.

(CLO-03) Able to analyze wave equations and derivatives.

(CPMK-04) Mampu menganalisis parameter-parameter antena.

(CLO-04) Able to analyze antenna parameters.

(CPMK-05) Mampu menyelesaikan permasalahan tentang saluran transmsi, mampu menggunakan smith chart.

(CLO-05) Able to solve problems about transmission channels, able to use the smith chart.

(CPMK-06) Mampu mendesain dan membuat suatu antena dan mengukur parameternya.

(CLO-06) Able to design and make an antenna and measure its parameters.

(CPMK-07) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-07) Demonstrating attitude of responsibility on work in his/her field of expertsei independently.

Topik/Pokok Bahasan

Main Subjects

1. Saluran Transmisi
   Transmission Channels
2. Propagasi gelombang bidang
   Field wave propagation
3. Pantulan dan transmisi gelombang
   Reflection and wave transmission
4. Integral radiasi
   Integral radiation
5. Parameter antenna
   Antenna parameters
6. Antena kawat
   Wire antenna
7. Antena pita lebar
   Broadband antenna
8. Antena array
   Antenna array
9. Teknik pengukuran antenna
   Antenna measurement technique

Pustaka

Reference(s)

[1] Fundamentals of Applied Electromagnetics, by Fawwas T. Ulaby, Prentice Hall International,Inc.
[2] Electronic Transmission technology by William Sinnema, Prentice Hall International, Inc.
[3] W. L. Stutzman, G. A. Thiele, Antenna Theory and Design 3rd Ed., John Wiley & Sons, 2012.
[4] C. A. Balanis, Antenna Theory, Analysis and Design 3rd Ed., John Wiley & Sons, 2005.

Prasyarat

Prerequisite(s)

EE184303 Medan Elektromagnetik

EE184303 Electromagnetic Fields

Mata Kuliah ***Course***	Nama MK *Name*	:	Jaringan dan Rekayasa Trafik *Networks and Traffic Engineering*
	Kode MK *Code*	:	EE184533
	Kredit *Credit*	:	4 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Gatot Kusrahardjo, MT
	Pengajar *Lecturer*	:	Ir. Gatot Kusrahardjo, MT Dr. Ir. Suwadi, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Jaringan dan Rekayasa Trafik membahas tentang jaringan yang meliputi evolusi teknologi jaringan telekomunikasi, sistem transmisi, sistem switching, switching time-division, kontrol sistem switching, pensinyalan, dan paket switching. Rekayasa trafik telekomunikasi membahas karakterisasi trafik, model matematik trafik, sistem rugi (Erlang B) dan sistem antrian (Erlang C), peramalan demand dan trafik rekayasa jaringan telekomunikasi.

Network and Traffic Engineering discusses networks which include the evolution of telecommunications network technology, transmission systems, switching systems, time-division switching, system switching control, signaling, and packet switching. Telecommunications traffic engineering discusses traffic characterization, traffic mathematical models, loss systems (Erlang B) and queuing systems (Erlang C), forecasting telecommunications network engineering demand and traffic.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep dasar jaringan, perkembangan jaringan telefoni dan rekayasa trafik telekomunikasi serta mampu merencanakan kapasistas sistem pada kasus jaringan telekomunikasi.

(CLO-01) Mastering the basic concepts of networks, the development of telephony networks and telecommunications traffic engineering and able to plan system capacities in the case of telecommunications networks.

(CPMK-02) Mampu menganalisis dasar jaringan, perkembangan jaringan telefoni dan rekayasa trafik telekomunikasi serta mampu merencanakan kapasistas sistem pada kasus jaringan telekomunikasi.

(CLO-02) Able to analyze the basis of the network, the development of telephone networks and telecommunications traffic engineering and be able to plan system capacity in the case of telecommunications networks.

(CPMK-03) Mampu menggunakan software Matlab untuk melakukan pembangkitan model matematik trafik dan membuat model simulasi sistem rugi dan sistem antrian.

(CLO-03) Able to use Matlab software to generate traffic mathematical models and create system loss simulation models and queuing systems.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

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

(CPMK-05) Working together to be able to make the most of their potential.

Topik/Pokok Bahasan
Main Subjects

1. Perkembangan telekomunikasi
   Development of telecommunications
2. Transmisi telekomunikasi
   Telecommunication transmission
3. Evolusi sistem switching
   Evolution of switching systems
4. Sistem switching
   Switching system
5. Switcing time-division
   Switcing time-division
6. Kontrol sistem switching
   Control switching systems
7. Pensinyalan
   Signaling
8. Paket switching
   Switching packages
9. Konsep jaringan
   Network concept
10. Konsep dasar besaran dan satuan trafik telekomunikasi
    Basic concept of quantity and unit of telecommunications traffic
11. Model matematik trafik telekomunikasi.
    Mathematical model of telecommunications traffic.

12. Sistem rugi (loss system), Erlang-B.
    Loss system, Erlang-B
13. Sistem antrian (queueing system) tak hingga, Erlang-C
    Unlimited queueing system, Erlang-C
14. Sistem antrian berhingga.
    Finite queue system.
15. Peramalan Trafik dan peramalan demand
    Traffic forecasting and demand forecasting

Pustaka

Reference(s)

[1] Thiagarajan Viswanathan, Telecommunication Switching System and Network, Prentice-Hall,1992
[2] Gilbert Held, S. Ravi Jagannathan, Practical Network Design Techniques, Second Edition, CRC Press, 2004
[3] Tarmo Anttalainen, Introduction to Telecommunication Network Engineering 2ed, Artech House, 2003
[4] Kesidis, G., "An introduction to Communication Network Analysis", Wiley, 2007.
[5] Iversen, Villy Bæk, "Teletraffic Engineering and Network Planning", Technical University of Denmark, Fotonic, 2015.
[6] T. S. Rappaport, "Wireless Communications: Principles and Practice", second edition, Prentice Hall, 2002

Prasyarat

Prerequisite(s)

- EE184405 Probabilitas, Statistik dan Proses Stokastik
  EE184405 Probability, Statistics, and Stochastic Processes
- EE184302 Dasar Sistem dan Jaringan Telekomunikasi
  EE184302 Introduction to Telecommunication Systems and Networks

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Komunikasi II *Communication Systems 2*
	Kode MK *Code*	:	EE184631
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Titiek Suryani, MT
	Pengajar *Lecturer*	:	Dr. Ir. Titiek Suryani, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Sistem Komunikasi II membahas tentang konsep Transmisi informasi digital dengan teknik modulasi digital biner dan M-ary yang terdiri dari amplitude shift keying (ASK), phase shift keying (FSK), phase-shift-keying (PSK) dan gabungan dua modulasi ASK-PSK (M-ary QAM), selain itu juga dibahas teknik pengkodean kanal untuk peningkatan kinerja sistem yang terganggu derau dan teknik pengkodean sumber untuk efisiensi kapasitas kanal.

The Communication Systems II course discusses the concept of digital information transmission with binary and M-digital modulation techniques consisting of amplitude shift keying (ASK), phase shift keying (FSK), phase-shift-keying (PSK) and a combination of two ASK modulations -PSK (M-ary QAM), besides, channel channeling techniques are also discussed to improve noise disturbed system performance and source coding techniques for channel capacity efficiency.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan perataturan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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 transmisi sinyal pesan secara digital meliputi modulasi biner dan M-ary dengan teknik demodulasi koheren menggunakan teknik matched filter, korelasi dan teknik deteksi maximum likelihood untuk memperoleh kembali sinyal pesan dengan tingkat kesalahan bit sekecil mungkin. Menguasi teknik pengkodean kanal dan teknik pengkodean sumber untuk meningkatkan kinerja sistem komunikasi digital sehingga daya dan bandwidthnya menjadi lebih effisien.

(CLO-01) Mastering the concept of digital message signal transmission includes binary and M-ary modulation with a coherent demodulation technique using matched filter techniques, correlation and maximum likelihood detection techniques to recover message signals with the smallest possible error rate. Mastering channel coding techniques and source coding techniques to improve the performance of digital communication systems so that their power and bandwidth become more efficient.

(CPMK-02) Mampu menganalisis teknik transmisi sinyal pesan digital baseband dan bandpass baik biner dan m-ary dan mampu menghitung kinerja sistem komunikasi digital dengan gangguan derau. Mampu meningkatkan kinerja sistem komunikasi digital menggunakan teknik pengkodean kanal dan teknik pengkodean sumber.

(CLO-02) Able to analyze the techniques of baseband and bandpass digital message signal transmission both binary and ary and able to calculate the performance of digital communication systems with noise disturbances. Able to improve the performance of digital

communication systems using channel coding techniques and source coding techniques.

(CPMK-03) Mampu menggunakan software Matlab/Simulink untuk melakukan visualisasi dan eksperimentasi konsep transmisi sinyal pesan secara digital biner dan m-ary melalui kanal dengan gangguan derau.

(CLO-03) Able to use Matlab / Simulink software to visualize and experiment the concept of transmitting digital binary and m-ary message signals through channels with noise disturbances.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

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

(CLO-05) Working together to be able to make the most of their potential.

Topik/Pokok Bahasan

Main Subjects

1. Konsep sinyal dalam sistem komunikasi.
   The concept of signals in a communication system.
2. Konsep deteksi sinyal biner baseband dalam derau Gausssian.
   The concept of detecting baseband binary signals in Gausssian noise.
3. Konsep modulasi dan demodulasi bandpass biner dan M-ary.
   The concept of binary and M-ary bandpass modulation and demodulation.
4. Konsep penerima koheren dan non-koheren.
   The concept of the recipient is coherent and non-coherent.

5. Teori perhitungan kinerja sinyal komunikasi digital.
   Theory of calculating the performance of digital communication signals.
6. Konsep pengkodean kanal.
   Concept of channel coding.
7. Teori informasi dan konsep pengkodean sumber.
   Information theory and source coding concepts.

Pustaka

Reference(s)

[1] Bernard Sklar and Pabitra Kumar Ray, Digital communications: Fundamentals and Applications, 2nd Edd., PEARSON, 2014.
[2] Hwei Hsu, Ph.D., Schaum's outline of theory and problems of Analog and Digital Communications, 2nd , Mc-Graw Hill, 2003.
[3] Leon W. Couch, II, Digital and analog communication systems, 8th Edition,Prentice Hall, 2016.
[4] Grahame Smillie, Analogue and Digital Communication Techniques, Butterworth-Heinemann, 1999.
[5] Michel C. Jeruchim, Philip Balaban, and K. Sam Shanmugan. Simulation of communication systems: modeling, methodology and techniques. Springer Science & Business Media, 2006.

Prasyarat

Prerequisite(s)

EE184531 Sistem Komunikasi I

EE184531 Communication Systems 1

Mata Kuliah ***Course***	Nama MK *Name*	:	Propagasi Gelombang *Wave Propagation*
	Kode MK *Code*	:	EE184632
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Puji Handayani, MT
	Pengajar *Lecturer*	:	Dr. Ir. Puji Handayani, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Propagasi Gelombang membahas tentang perambatan gelombang elektromagnetik mulai spektrum Extra Low frequency (ELF), Very Low frequency (VLF), Low Frequency (LF), Middle Frequency (MF), High frequency (HF), Very High frequency (VHF), Super High frequency (SHF) sampai dengan Extra High frequency (EHF), prediksi redaman propagasi di masing-masing pita frekuensi tersebut, mekanisme perambatan gelombang di masing-masing pita frekuensi tersebut dan disain link transmisi untuk masing-masing pita frekuensi tersebut.

The course discusses the propagation of electromagnetic waves from the spectrum of the Extra Low frequency (ELF), Very Low frequency (VLF), Low Frequency (LF), Middle Frequency (MF), High frequency (HF), Very High frequency (VHF), Super High frequency (SHF) up to Extra High frequency (EHF), prediction of propagation attenuation in each of these frequency bands, wave propagation mechanism in each of these frequency bands and transmission link design for each of these frequency bands.

CPL Prodi yang Dibebankan

Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by

considering safety, social, cultural, environmental and economic aspects

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep perambatan gelombang di semua spektrum frekuensi.

(CLO-01) Mastering the concept of wave propagation in all frequency spectrums.

(CPMK-02) Mampu menghitung atau memprediksi redaman pada saat gelombang berpropagasi.

(CLO-02) Able to calculate or predict attenuation when the wave propagates.

(CPMK-03) Mampu mengalisa dan mendisain suatu link transmisi radio antar dua titik.

(CLO-03) Able to analyze and design a radio transmission link between two points.

Topik/Pokok Bahasan

Main Subjects

1. Perambatan gelombang di ruang bebas.
   Wave propagation in free space.
2. Pembiasan oleh lapisan atmosfir
   Refraction by the atmosphere layer
3. Pantulan
   Reflection

4. Difraksi
   Diffraction
5. Efek Hujan
   Rain Effect
6. Surface wave dan Ionospheric wave
   Surface wave and Ionospheric wave
7. Noise
   Noise
8. Pemodelan matematis kanal lintasan jamak
   Multi-channel canal mathematical modeling
9. Kanal propagasi radio bergerak: redaman skala besar
   Mobile radio propagation channels: large scale attenuation
10. Kanal propagasi radio bergerak: multipath fading
    Mobile radio propagation channel: multipath fading
11. Pengukuran kanal propagasi radio
    Measurement of radio propagation channels
12. Underwater acoustic wave
    Underwater acoustic wave

Pustaka

Reference(s)

[1] J. D. Parsons, Mobile radio propagation channel, John Wiley & Sons, 2000.
[2] Simon R. Saunders , Alejandro Aragon-Zavala, Antennas and Propagation for Wireless Communication Systems, John Wiley &Sons, 2007.
[3] Robert E. Collin, Antenna and Radiowave Propagation, Mc Graw Hill, 1985.
[4] Theodore S. Rappaport, Wireless Communications Principles and Practice, 2nd ed., Dorling Kindersley, 2009.
[5] Xavier Lurton, An Introduction to Underwater Acoustics, Springer-Praxis, 2002.

Prasyarat

Prerequisite(s)

EE184303 Medan Elektromagnetik

EE184303 Electromagnetic Fields

Mata Kuliah ***Course***	Nama MK *Name*	:	Elektronika Telekomunikasi Communication Electronics
	Kode MK *Code*	:	EE184633
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Endroyono, DEA
	Pengajar *Lecturer*	:	Dr. Ir. Endroyono, DEA
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata-kuliah ini memberi dasar pemahaman dan disain elektronika frekuensi tinggi, terutama frekuensi gelombang mikro dan yang lebih tinggi. Pada frekuensi tinggi besaran tegangan, arus, impedansi, dan proses perambatan gelombang sudah tidak mungkin lagi hanya dianalisis menggunakan pendekatan rangkaian listrik dan elektronika biasa. Untuk itulah diperlukan pengetahuan mendalam tentang sifat khusus komponen RF saluran transmisi, impedansi, koefisien refeksi, scattering parameter untuk rangkaian N-port, dan berbagai aspek penting yang diperlukan dalam rangka disain rangkaian aktif dan pasif elektronika telekomunikasi, seperti amplifier RF, Mixer dan Oscillator. Yang tidak kalah pentingnya, dalam kuliah ini diajarkan perancangan elektronika telekomunikasi menggunakan tool atau alat bantu pemrograman, contohnya menggunakan Matlab.

This course provides a basis for understanding and designing high frequency electronics, especially microwave and higher frequencies. At high frequencies the voltage, current, impedance and wave propagation quantities are no longer possible only to be analyzed using the ordinary electrical and electronic circuit approach. For this reason, it requires in-depth knowledge about the specific properties of RF transmission line components, impedance, refraction coefficient, scattering parameters for N-port circuits, and various important aspects needed in the design of active and passive telecommunications telecommunications circuits, such as RF amplifiers, Mixers and Oscillators. Equally important, in this lecture is taught telecommunications telecommunications design using a tool or programming tool, for example using Matlab.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi

data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-03) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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.

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasasi konsep, prinsip, dan prosedur perancangan elektronika telekomunikasi di bidang telekomunikasi multimedia, yang melibatkan 3 aspek utama, yaitu frekuensi, impedansi dan sifat elektromagnetik.

(CLO-01) Mastering the concepts, principles and procedures of telecommunications electronic design in the field of multimedia telecommunications, which involves 3 main aspects, namely frequency, impedance and electromagnetic properties.

(CPMK-02) Mampu memformulasikan permasalahan rekayasa elektronika telekomunikasi, mampu mendeskipsikan rancangan sistem (misalnya, amplifier RF) dan mampu memanfaatkan perangkat analisis dan rekayasa berbasis teknologi (MatLab, CST).

(CLO-02) Able to formulate telecommunication electronics engineering problems, able to describe system design (for example, RF amplifiers) and be able to utilize technology-based analysis and engineering tools (MatLab, CST).

(CPMK-03) Mampu mengambil keputusan secara tepat dalam kontek penyelesaian masalah Elektronika Telekomunikasi, berdasarkan analisis informasi dan data terkait, termasuk pemanfaatan alat-bantu pemrograman.

(CLO-03) Able to make decisions appropriately in the context of solving Telecommunications Electronics problems, based on analysis of information and related data, including the use of programming tools.

(CPMK-04) Menjunjukkan sikap bertanggung-jawab atas pekerjaan di bidang keahliannya secara mandiri, karena kekhususan bidang elektronika telekomunikasi.

(CLO-04)Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan

Main Subjects

1. Sistem dan Komponen Elektronika Telekomunikasi / RF
   Telecommunications / RF Electronics Components and Systems
2. Sifat Komponen pasif RF di Frekuensi Tinggi
   Properties of Passive RF Components at High Frequency
3. Analisis Saluran Transmisi dalam disain sistem RF
   Transmission Line Analysis in RF system design
4. Pemanfaatan smith-chart dan pemrograman dalam analisis dan disain
   Use of smith-charts and programming in analysis and design

5. Single & Multiport Network
   Single & Multiport Network
6. Scattering Parameters
   Scattering Parameters
7. Disain Amplifier RF
   RF Amplifier Design
8. Teknik penyesuaian impedansi dan transformasi impedansi
   Technique of adjusting impedance and impedance transformation
9. Konsep Disain filter dan oscillator frekuensi tinggi
   High-frequency filter and oscillator design concepts

Pustaka

Reference(s)

[1] Endroyono,dkk. “Modul Ajar Elektronika Telekomunikasi dan Manual Praktikum” 2014
[2] Reinhold Ludwig&Pavel Bretchko, “RF Circuit Design, Theory and Applications”, Prentice-Hall, 2000.
[3] MatLAB files dari Reinhold Ludwig&Pavel Bretchko, “RF Circuit Design, Theory and Applications”, Prentice-Hall, 2000.
[4] David M. Pozar, “Microwave Engineering” John Willey & Sons, 4th Edition, 2011
[5] Thomas S. Lavergetta, “Microwave and wireless RF Simplfied”, Artech House, 2nd Edition, 2005

Prasyarat

Prerequisite(s)

- EE184306 Rangkaian Elektronika
  EE184306 Electronic Circuits
- EE184532 TGE & Antenna
  EE184532 Electromagnetic Wave Transmission and Antennas

Mata Kuliah ***Course***	Nama MK *Name*	:	Jaringan Komunikasi Nirkabel *Wireless Communication Networks*
	Kode MK *Code*	:	EE184634
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Achmad Affandi, DEA
	Pengajar *Lecturer*	:	Dr. Ir. Achmad Affandi, DEA
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Sistem Komunikasi Nirkabel membahas prinsip sistem komunikasi nirkabel, standar teknologi dan aristektur sistem komunikasi nirkabel. Selanjutnya pembahasan analisis kinerja serta perencanaan dan kinerja jaringan komunikasi nirkabel.

The course discusses the principles of wireless communication systems, technology standards and the architecture of wireless communication systems. Next is the discussion of performance analysis and planning and performance of wireless communication networks.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(*PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering*

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Mahasiswa mengetahui perkembangan teknologi sistem dan jaringan komunikasi nirkabel, serta memahami perencanaan dan kinerja jaringan komunikasi nirkabel.

(CLO-01) Students are aware of the development of wireless communication systems and network technologies, and understand the planning and performance of wireless communication networks.

(CPMK-02) Mampu menjelaskan teknologi sistem komunikasi nirkabel

(CLO-02) Able to explain wireless communication system technology

(CPMK-03) Mampu menjelaskan teknik dan rekayasa sistem komunikasi nirkabel

(CLO-03) Able to explain the techniques and engineering of wireless communication systems

(CPMK-04) Mampu menjelaskan perencanaan jaringan komunikasi nirkabel

(CLO-04) Able to explain wireless communication network planning

(CPMK-05) Mampu menjelaskean kinerja sistem komunikasi nirkabel memahami aspek propagasi dan transmisi pada sistem komunikasi nirkabel

(CLO-05) Able to explain the performance of wireless communication systems understands the propagation and transmission aspects of wireless communication systems

(CPMK-06) Mampu menjelaskan evaluasi kinerja jaringan komunikasi nirkabel

(CLO-06) Able to explain the performance evaluation of wireless communication networks

(CPMK-07) Mampu menjelaskan konsep teknologi komunikasi nirkabel

(CLO-07) Able to explain the concept of wireless communication technology

(CPMK-08) Mampu menjelaskan karakteristik media kanal komunikasi bergerak

(CLO-08) Able to explain the characteristics of mobile communication channel media.

(CPMK-09) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri

(CLO-09) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan

Main Subjects

1. Sistem komunikasi nirkabel
   Wireless communication system
2. Konsep komunikasi seluler bergerak
   The concept of mobile cellular communication
3. Teknologi dan Standard Komunikasi Nirkabel
   Technology and Wireless Communication Standards
4. Perencanaan Jaringan komunikasi nirkabel
   Planning wireless communication networks
5. Kinerja Jaringan Komunikasi Nirkabel
   Wireless Communication Network Performance

Pustaka

Reference(s)

[1] K Daniel Wong, Fundamentals of Wireless Communication Engineering Technologies, John Willey & Sons, 2012

[2] R. Prasad, A. Milhovska, New Horizons in Mobile and Wireless communications, Artech House, 2009
[3] Yan Zhang, WiMAX Network Planning and Optimization-CRC Press, 2009
[4] Farooq Khan, LTE for 4G Mobile Broadband Air Interface Technologies and Performance, Cambridge UP, 2009
[5] Harri Holma, Antti Toskala, HSDPA/HSUPA for UMTS, John Willey & Sons, 2006

Prasyarat

Prerequisite(s)

- EE184531 Sistem Komunikasi I
  EE184531 Communication Systems 1
- EE184533 Jaringan dan Rekayasa Trafik
  EE184533 Networks and Traffic Engineering

Mata Kuliah (MK)	Nama MK *Name*	:	Lab. Telekomunikasi *Basic Laboratory of Electricity and Telecommunication Systems*
	Kode MK *Code*	:	EE184731
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	VII (Wajib) *VII (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Eko Setiadji, ST, MT, PhD
	Pengajar *Lecturer*	:	Eko Setiadji, ST, MT, PhD Dr. Ir. Wirawan, DEA Devy Kuswidiastuti, ST, M.Sc
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Lab Telekomunikasi ini memberikan kemampuan kepada mahasiswa untuk mengukur, melakukan tes dan menganalisis karakteristik peralatan yang ada di bidang telekomunikasi dan melakukan pengolahan sinyal secara digital serta jaringan dan rekayasa protokol internet secara praktis menggunakan simulator hardware maupun software. Materi yang dipelajari meliputi pengukuran dan analisis karakteristik antena sederhana dipole λ/2, melakukan tes Polarisasi Antena, pengukuran pengaruh jarak Antena dengan detektor dalam kekuatan radiasi, pengukuran resiprositas Antena, dan melakukan 'matching impedance', membangkitkan dan menganalisis karakteristik sinyal digital baseband, deteksi optimum, modulasi dan demodulasi passband dan teknik pengkodean kanal siklik, serta jaringan LAN/WAN, VPN, infrastruktur layanan, kinerja jaringan dan layanan.

The course gives students the ability to measure, test and analyze the characteristics of existing equipment in the telecommunications sector and perform digital signal processing as well as network and internet protocol engineering practically using hardware and software simulators. The material studied includes measurement and analysis of simple dipole λ / 2 antenna characteristics, performing Antenna Polarization tests, measuring the effect of antenna distance with a detector in radiation strength, measuring antenna reciprocity, and performing 'impedance matching', generating and analyzing baseband digital signal characteristics, detection optimum, passband modulation and demodulation and cyclic channel coding techniques, as well as LAN / WAN networks, VPN, service infrastructure, network performance and services.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-02) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-07) Capable to communicate effectively both in written and oral form

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, saling menghormati.

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai teknik pengukuran dan menunjukkan karakteristik parameter antenna, menguasai teknik pengolahan sinyal komunikasi secara digital, dan menguasai jaringan dan rekayasa protokol internet secara praktis.

(CLO-01) Mastering measurement techniques and demonstrating antenna parameter characteristics, mastering digital communication signal processing techniques, and mastering network and internet protocol engineering practically.

(CPMK-02) Mampu menganalisis parameter-parameter ukur antenna terhadap kinerjanya, mampu mengolahan sinyal komunikasi untuk transmisi digital dan karakteristiknya, dan menguasai jaringan dan rekayasa protokol internet secara praktis.

(CLO-02) Able to analyze antenna measurement parameters on its performance, be able to process communication signals for digital transmission and its characteristics, and master network and internet protocol engineering practically.

(CPMK-03) Mampu menggunakan: modul praktikum antenna dan mencatat parameternya, modul praktikum pengolahan sinyal komunikasi dan menganalisis karakteristiknya, modul praktikum jaringan dan rekayasa protokol internet.

(CLO-03) Able to use: antenna practicum module and record its parameters, communication signal processing practicum module and analyze its characteristics, network practicum module and internet protocol engineering.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrate an attitude of responsibility for work in their field of expertise independently.

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

(CLO-05) Working together to be able to make the most of their potential.

Topik/Pokok Bahasan

Main Subjects

1. Karakteristik Antena Simple Dipole λ/2
   Characteristics of Simple Dipole Antenna λ / 2
2. Prosedur Tes Polarisasi Antena
   Antenna Polarization Test Procedure
3. Karakteristik Jarak Antena Dengan Detektor Dalam Kekuatan Radiasi

Characteristics of Distance Antenna With Detector In Radiation Strength

4. Resiprositas Antena
   Antenna reciprocity
5. Disain Penyesuai impedansi antena menggunakan teknik Matching Stub.
   Design Antenna impedance matching using the Matching Stub technique.
6. Jenis dan Karakteristik sinyal baseband.
   Types and characteristics of baseband signals.
7. Karakteristik Matched filter dan Korelator untuk deteksi optimal Maksimum Likelihood sinyal digital.
   Matched filter and correlator characteristics for optimal Maximum Likelihood detection of digital signals.
8. Karakteristik sinyal modulasi passband biner.
   Characteristics of the binary passband modulation signal.
9. Karakteristik sinyal modulasi passband m-ary.
   Characteristics of m-ary passband modulation signal.
10. Pengkodean kanal kode siklik.
    Cyclic code channel coding.
11. Implementasi LAN
    LAN implementation
12. Implementasi WAN
    WAN implementation
13. Implementasi VPN
    Implementation of VPN
14. Kinerja jaringan dan layanan berbasis IP
    Network performance and IP-based services

Pustaka

Reference(s)

[1] "Antenna Trainer", BYTRONIC Education Technology
[2] Kwonhue Choi and Huaping Liu, "Problem-Based-Learning-in-Communication-Systems-Using-MATLAB-and-Simulink", John Wiley & Sons, Inc., Hoboken, New Jersey, 2016.

[3] John G. Proakis, Masoud Salehi and Gerhard Bauch, Contemporary Communication Systems using MATLAB, 3rd edition, Cengage Learning, 2013.
[4] Mathuranathan Viswanathan , Simulation of Digital Communication systems using MATLAB, 2nd Edition, Mathuranathan Viswanathan at Amazon, 2013.
[5] Cisco Secure Router 520 Series Software Configuration Guide, Cisco Systems, Inc, 2008

Prasyarat

Prerequisite(s)

- EE184532 TGE dan Antena
  EE184532 Electromagnetic Wave Transmission and Antenna
- EE184631 Sistem Komunikasi 2
  EE184631 Communication Systems 2
- EE184936 Rekayasa Internet dan Web
  EE184936 Internet Engineering and Web

4. MK Bidang Keahlian: Elektronika *(Specialization Field Course: Electronic Engineering)*

Mata Kuliah ***Course***	Nama MK *Name*	:	Divais Semikonduktor & R.Terintegrasi *Semiconductor Devices and Integrated Circuits*
	Kode MK *Code*	:	EE184541
	Kredit *Credit*	:	4 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Astria Nur Irfansyah, ST, M.Eng
	Pengajar *Lecturer*	:	Ir. Gatot Kusrahardjo, MT Dr. Ir. Suwadi, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	Requirement and Regulation	*A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini membahas tentang teori bahan semikonduktor, prinsip kerja berbagai kelompok divais semikonduktor, fabrikasi divais semikonduktor, serta perancangan rangkaian terintegrasi analog, digital, dan mixed-signal dengan teknologi mikroelektronika CMOS (*complementary metal-oxide semiconductor*). Bagian pertama mata kuliah ini memperkenalkan teori dan prinsip kerja berbagai divais semikonduktor untuk berbagai jenis aplikasi, serta proses fabrikasinya. Bagian kedua mata kuliah ini menekankan pada aspek perancangan integrated circuit (IC), meliputi tahap rancangan skematik, simulasi, hingga layout untuk IC menggunakan CAD (*computer aided design*) tools untuk perancangan IC.

This course develops the understanding of semiconductor devices and skills in integrated circuit (IC) design. The topics include theory of semiconductor materials, operating principles and fabrication of semiconductor devices, and the design of digital, analogue, and mixed signal IC, in CMOS (complementary metal-oxide semiconductor) technology. The first part of the course introduces fundamental theories and operating principles of semiconductor devices for various applications, as well as the fabrication process of semiconductor materials and integrated circuits. The second part of this course develops skills on ICdesign, covering schematic entry, simulation, and IC layout using computer aided design (CAD) tools.

CPL Prodi yang Dibebankan

Course Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan

mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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 teori bahan semikonduktor, berbagai kelompok divais semikonduktor beserta prinsip kerjanya, proses fabrikasi divais semikonduktor dan fabrikasi rangkaian terintegrasi. Menguasai teknik perancangan rangkaian terintegrasi analog dan digital untuk teknologi CMOS hingga tahap simulasi dan layout.

(CLO-01) Understanding the theory of semiconductor materials , various groups of semiconductor devices with their operating principles, semiconductor device and integrated circuits fabrication. Mastering analogue and digital integrated circuit design techniques in CMOS technology, from simulation stage to complete IC layout.

(CPMK-02) Mampu melakukan simulasi karakteristik divais semikonduktor dengan software bantu, melakukan perancangan dan

simulasi rangkaian analog dan digital CMOS dengan SPICE dan mampu melakukan perancangan gambar layout rangkaian terintegrasi CMOS dengan IC design tool yang tersedia.

(CLO-02) Able to perform simulations of semiconductor device using computer software, design and simulation of analogue and digital CMOS circuits in SPICE, and able to implement CMOS IC layout using CAD tools.

(CPMK-03) Memahami teori bahan semikonduktor, berbagai kelompok divais semikonduktor beserta prinsip kerjanya, proses fabrikasi divais semikonduktor dan fabrikasi rangkaian terintegrasi.

(CLO-03) Understanding the theory of semiconductor materials, semiconductor devices and their operating principles, and semiconductor and IC fabrication technology.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Showing responsibility in the field of expertise. Working together to be able to take full advantage of their potential.

Topik/Pokok Bahasan

Main Subjects

1. Teori atom, teori bahan semikonduktor, pita energi, doping.
   Model of atom, semiconductor materials, energy band, doping.
2. Sambungan PN, dioda.
   PN junction, diodes.
3. Transistor bipolar.
   Bipolar transistors.
4. Transistor MOSFET, FinFET, SOI.
   MOSFET, FinFET, silicon-on-insulator.
5. Piranti optoelektronik, semikonduktor organik, piranti frekuensi tinggi, piranti dengan quantum effect, dan piranti daya tinggi.
   Optoelectronic devices, organic semiconductor, high-frequency devices, quantum effect devices, power electronic devices.

6. Proses fabrikasi teknologi VLSI, alur perancangan IC.
   VLSI technology fabrication, IC design flow.
7. Prinsip layout IC, dan tool untuk IC design dan verifikasinya.
   Principles of integrated circuit layout, IC design tools & verification.
8. Rancangan rangkaian terintegrasi CMOS logika statis, sekuensial, standard-cell layout.
   Design of CMOS static logic circuits, sequential circuits, and standard-cell layout.
9. Rancangan rangkaian terintegrasi CMOS analog, teknik layout.
   Design of analogue CMOS circuits, layout techniques.
10. Rancangan rangkaian terintegrasi mixed-signal seperti ADC dan DAC sederhana dengan teknologi CMOS.
    Design of simple mixed signal CMOS circuit, including ADC and DAC.

Pustaka

Reference(s)

[1] R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 2nd edition, IEEE Press, Wiley-Interscience, 2005, USA.
[2] Adel Sedra, Kenneth Smith, "Microelectronic Circuits: Theory and Applications", 6th edition, Oxford University Press, 2011.
[3] Ben Streeman, Sanjay Banerjee, "Solid State Electronic Devices", 6th edition, Pearson, 2006.

Prasyarat

Prerequisite(s)

EE184306 Rangkaian Elektronika

EE184306 Electronic Circuits

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Elektronika Tertanam *Embedded Electronic System*
	Kode MK *Code*	:	EE184542
	Kredit *Credit*	:	4 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ronny Mardiyanto, ST, MT
	Pengajar *Lecturer*	:	Dr. Ronny Mardiyanto, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini mempelajari tentang Sistem Elektronika Tertanam (Sistem yang memiliki chip yang diprogram hanya untuk keperluan tertentu) yang diimplementasikan pada sistem mikrokontroler, terdiri dari perkembangan mikroprosesor menuju mikrokontroler, tipe-tipe mikrokontroler, bahasa pemrograman, dan implementasinya. Mata kuliah ini juga mempelajari tentang bagaimana menggunakan berbagai macam tipe mikrokontroler meliputi: Mikrokontroler MCS 51, Mikrokontroler AVR, Arduino, Mikrokontroler ARM 32bit, dan Raspberry Pi.

This course studies the Embedded Electronics System (System that has a chip that is programmed only for certain purposes) which is implemented in microcontroller system, consisting of microprocessor development to microcontroller, microcontroller type, programming language, and its implementation. This course also learns about how to use various types of microcontroller include: MCS 51 Microcontroller, AVR Microcontroller, Arduino, 32bit ARM Microcontroller, and Raspberry Pi.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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 dasar dari mikrokontroler MCS51, AVR, ARM 32bit, dan Embedded System.

(CLO-01) Master the basic concepts of microcontroller MCS 51, AVR, ARM 32 bit, and Embedded System.

(CPMK-02) Mampu menerapkan konsep mikrokontroler tipe MCS51, AVR, ARM 32 bit, dan Embedded System

(CLO-02) Mastering the concept of microcontroller type MCS51, AVR, ARM 32 bit, and Embedded System

(CPMK-03) Mampu mengimplementasikan mikrokontroler tipe MCS51, AVR, ARM 32 bit, dan Embedded system board

(CLO-03) Able to implement microcontroller type MCS51, AVR, ARM 32 bit, and Embedded system board.

(CPMK-04) Mampu menginternalisasi semangat kemandirian, kejuangan, dan kewirausahaan

(CLO-04) Able to internalize the spirit of independence, struggle, and entrepreneurship.

Topik/Pokok Bahasan
Main Subjects

1. Pengantar Sistem Elektronika Tertanam
   Introduction of Embedded Systems
2. Mikrokontroler MCS 51
   Microcontroller MCS 51
3. GPIO, Timer, Counter, Interupt, Komunikasi Serial, I2C, CAN, Onewire
   GPIO, Timer, Counter, Interupt, Serial Communication, I2C, CAN, Onewire
4. Bahasa Assembly untuk MCS 51
   Assembly Language for MCS 51
5. Basic Compiler dan C++ untuk MCS 51
   Basic Compiler and C ++ for MCS 51
6. Mikrokontroler AVR
   AVR microcontroller
7. Mikrokontroler ARM 32bit
   ARM Microcontroller32bit
8. Raspberry Pi
   Raspberry Pi

Pustaka
Reference(s)

[1] Buku Ajar Embedded System, Ronny Mardiyanto, 2018
[2] Matt Richardson, Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly Media, 2012
[3] ARM Cortex M0 Nuvoton NuMicro, dalam bentuk CD
[4] Manual Book STM32
[5] Robert Love, Linux Kernel Development, Addison-Wesley, 2010

Prasyarat
Prerequisite(s)

EE184401 Sistem Digital dan Mikroprosesor

EE184401 Digital and Microprocessor Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Sensor dan Akuator *Sensors and Actuators*
	Kode MK *Code*	:	EE184543
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	V (Wajib) *V (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Harris Pirngadi, MT
	Pengajar *Lecturer*	:	Ir. Harris Pirngadi, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah sensor dan aktuator membahas tentang konsep dan prinsip kerja sensor dan aktuator melalui pendekatan ilmu fisika, terminologi dan parameter pada sensor dan aktuator, material dan teknologi dalam pembuatan sensor dan aktuator, analisis sensor dan aktuator pada sistem kontrol, desain dan rekayasa sensor dan aktuator pada sebuah sistem kontrol umpan balik tertutup.

This course studies the implementation of digital circuits and systems using programmable hardware components of FPGA, which also include design procedures using HDL (Hardware Description Language) such as VHDL or Verilog, and the use of EDA tools for designing. Implementation includes design of combinational circuits, sequential circuits, FSM, DSP, digital filter circuit, and microprocessor design.

CPL Prodi yang Dibebankan

Learning Outcomes

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

(PLO-01) 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) Mampu menjelaskan konsep dasar sensor dan aktuator.
(CLO-01) Mastering basic concept of sensors and actuators

(CPMK-02) Mampu menghitung menganalisis parameter-parameter dalam sensor dan aktuator.
(CLO-02) Able to calculate analyze parameters in sensors and actuators.

(CPMK-03) Mampu merancang, merekayasa, dan menganalisis sensor dan aktuator sesuai kebutuhan.
(CLO-03) Able to design, engineer, and analyze sensors and actuators as needed.

(CPMK-04) Mampu menganalisis dan mengambil keputusan dalam menyelesaikan masalah terkait sensor dan aktuator.
(CLO-04) Able to analyze and take decisions in solving problems related to sensors and actuators.

(CPMK-05) Mampu bekerja secara mandiri dan kelompok dalam melaksanakan tugas dan tanggung jawabnya.
(CLO-05) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Deskripsi sensor,transduser dan aktuator.
   Description of sensors, transducers and actuators.
2. Parameter dan karakteristik sensor dan aktuator.
   Parameters and characteristics of sensors and actuators.

3. Prinsip kerja sensor tegangan, arus dan phasa listrik.
   The working principle of voltage sensor, current and electric phases.
4. Prinsip kerja sensor posisi, perpindahan, kecepatan dan akselerasi.
   The working principle of position sensor, displacement, speed and acceleration.
5. Prinsip kerja sensor gaya, tekanan dan aliran.
   The working principle of force, pressure and flow sensors.
6. Prinsip kerja sensor temperatur, kelembaban dan pH.
   The working principle of temperature sensor, humidity and pH.
10. Prinsip kerja sensor intensitas cahaya dan radiasi.
    The working principle of light intensity and radiation sensors.
11. Teknologi pembuatan Sensor.
    Sensor manufacture technology.
12. Prinsip kerja pemanas, solenoid dan motor.
    Working principle of heater, solenoid and motor.
10. Prinsip kerja penggerak jenis kontaktor, solid state switch dan dan inverter.

    The working principle of the type of contactor, solid state switch and inverter.

Pustaka

Reference(s)

[1] Fraden, J. (2010). Handbook of modern sensors: physics, designs, and applications. New York, NY: Springer.
[2] Morris, Alan S. (2006). Measurement and Instrumentation Principles. Elsevier, Butterworth Heinemann.

Prasyarat

Prerequisite(s)

- EE184303 Medan Elektromagnetik
  EE184303 Electromagnetics
- EE184306 Rangkaian Elektronika
  EE184306 Electronic Circuits

Mata Kuliah ***Course***	Nama MK *Name*	:	Perancangan Sistem Elektronika Analog *Design of Analog Electronic Systems*
	Kode MK *Code*	:	EE184641
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Mohammad Rivai, ST, MT
	Pengajar *Lecturer*	:	Dr. Mohammad Rivai, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Perancangan Sistem Elektronika Analog membahas tentang proses analisis, simulasi, perancangan dan deskripsi aplikasi rangkaian Operational amplifier dan parameternya, Precision Rectifier, Osilator dan timer, Voltage-controlled oscillator, one-shot multivibrator, Pulse-width modulation, Digital to Analog Conversion, Analog to Digital Conversion, Logarithmic dan Antilog amplifier, Linear voltage regulator, switching regulator, Analog proportional-integral-derivative control, Switched Capacitor, Field Programmable Analog Array, Power Amplifier, Phase-locked loop, Lock-In Amplifier.

The course of Analog Electronic Systems Design discusses: Analysis, simulation, design and application of Operational Amplifier & its parameters, Precision Rectifier, Oscillator & Timer, Voltage-controlled Oscillator, One-shot Multivibrator, Pulse-width Modulation, Digital to Analog Conversion, Analog to Digital Conversion, Logarithmic and Antilog Amplifier, Linear Voltage Regulator, Switching Regulator, Analog Proportional-Integral-Derivative Controller, Switched Capacitor, Field Programmable Analog Array, Power Amplifier, Phase-locked Loop, Lock-in Amplifier circuits.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-02) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan

mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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, prinsip dan prosedur perancangan sistem elektronika analog untuk menunjang keperluan proses analisis, simulasi, perancangan dan deskripsi aplikasi rangkaian analog.

(CLO-01) Mastering the concepts and principles of design procedure for analysis, simulation, and application of analog electronic systems.

(CPMK-02) Mampu mendeskripsikan rancangan sistem elektronika analog untuk penyelesaian masalah dalam sistem tenaga listrik, sistem pengaturan, telekomunikasi multimedia, atau elektronika dengan mempertimbangkan standar teknis, aspek kinerja, keandalan, kemudahan penerapan, dan jaminan keberlanjutan.

(CLO-02)Able to describe the design of analog electronic systems for problem solving in power systems, control systems, multimedia telecommunications, or electronics by concerning technical standards, performance aspect, reliability, ease of application, and assurance of sustainability.

(CPMK-03) Mampu menerapkan proses analisis, simulasi, perancangan dan deskripsi aplikasi sistem elektronika analog.

(CLO-03) Able to apply the analysis, simulation, design, and application of analog electronic systems

(CPMK-04) Menunjukkan sikap bertanggungjawab yang berkenaan dengan proses analisis, simulasi, perancangan dan deskripsi aplikasi sistem elektronika analog secara mandiri.

(CLO-04) Demonstrating attitude of responsibility regarding the analysis, simulation, design, and application of analog electronic systems independently.

Topik/Pokok Bahasan

Main Subjects

1. Precision Rectifier
   Precision Rectifier
2. Osilator dan timer
   Osilator & Timer
3. Digital-Analog Conversion
   Digital-Analog Conversion
4. Logarithmic dan Antilog amplifier
   Logarithmic & Antilog Amplifier
5. Voltage regulator
   Voltage Regulator
6. Analog proportional-integral-derivative control
   Analog Proportional-Integral-Derivative Controller
7. Switched Capacitor
   Switched Capacitor
8. Power Amplifier
   Power Amplifier
9. Phase-locked loop
   Phase-locked Loop
10. Lock-In Amplifier
    Lock-in Amplifier

Pustaka

Reference(s)

[1] Muhammad Rivai, 2018. Diktat: Perancangan Sistem Elektronika Analog.
[2] Thomas L Floyd and David Buchla, Fundamentals of Analog Circuits, Pearson Custom Publishing, 2012.

Prasyarat

Prerequisite(s)

EE184501 Rangkaian Analog

EE184501 Analog Circuits

Mata Kuliah ***Course***	Nama MK *Name*	:	Akuisisi Data dan Pengolahan Sinyal *Acquisition and Signal Processing*
	Kode MK *Code*	:	EE184642
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Tasripan, MT
	Pengajar *Lecturer*	:	Ir. Tasripan, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Akuisisi Data dan Pengolahan Sinyal membahas tentang karakteristik transduser, sistem pengkondisian sinyal, Rangkaian Isolasi, Rangkaian Filter Analog, Rangkaian sistem konversi sinyal Digital ke Analog (DAC), dan Rangkaian sistem konversi sinyal Analog ke Digital (ADC). Dan membahas konsep Pengolahan Sinyal Digital dari hasil ADC dengan Filter Digital untuk Sistem Akuisisi Data.

The course of Data Acquisition and Signal Processing discusses transducer characteristics, signal conditioning system, Isolation Circuits, Analog Filter Circuits, Digital to Analog signal conversion system (DAC), and Analog to Digital (ADC) signal conversion system. It discusses the concept of Digital Signal Processing from ADC results with Digital Filters for Data Acquisition System.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-02) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-09) Capable to learn independently to foster lifelong learning abilities

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep transduser dan karakteristiknya, pengkondisian sinyal, sistem konversi sinyal digtal ke analog (DAC), sistem konversi sinyal analog ke digital (ADC) dan konsep Filter Digital.

(CLO-01) Mastering the concept of transducers and their characteristics, signal conditioning, digital to analog signal conversion systems (DAC), analog to digital signal conversion systems (ADC), and the concept of Digital Filters.

(CPMK-02) Mampu menganalisis transduser dan pegkondisian sinyal analog untuk dikonversi ke digital (ADC) dan mampu menganalisis sistem konversi sinyal digtal ke analog (DAC). Dan mampu menganalisis pengolahan sinyal dengan pemrograman.

(CLO-02) Able to analyze transducer and analog signal conditioning to convert to digital signal (ADC) and able to analyze conversion system of digital to analog (DAC), and able to analyze signal processing along with programming.

(CPMK-03) Mampu merancang dan merealisasikan sistem akuisisi data dan pengolahan sinyal dalam bidang Elektro.

(CLO-03) Able to design and realize data acquisition and signal processing system in various application fields.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field independently concerning to Data Acquisition and Signal Processing.

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

(CLO-05) Working together to be able to take full advantage of their potential concerning to Data Acquisition and Signal Processing.

Topik/Pokok Bahasan

Main Subjects

1. Transduser dan karakteristiknya.
   Transducer and its characteristics.
2. Sistem pengkondisian sinyal
   Signal conditioning system.
3. Rangkaian Isolasi, dan Filter Analog.
   Isolation Circuit, and Analog Filter.
4. ADC jenis Flash, Counter Ramp, dan Successive Approximation Register
   Flash type ADC, Counter Ramp, and Successive Approximation Register
5. DAC jenis Weighted Resistor dan R2R Ladder.
   DAC type Weighted Resistors and R2R Ladder.
6. Sistem filter digital (LPF, HPF, BPF, BSF) menggunakan matlab dan metoda z-plane.
   Digital filter system (LPF, HPF, BPF, BSF) using matlab and z-plane method.
7. Sistem Akuisisi Data dan Pengolahan Sinyal.
   Data Acquisition and Signal Processing System.

Pustaka

Reference(s)

[1] Joseph J Carr, Sensor and Circuits, Prentice Hall Inc., 1993.

[2] Instrumentation Amplifier Application Guide, Charles Kitchin and Lew Counts, Analog Device, 1992.
[3] Data Acquisition Handbook, Analog Device.
[4] Data Acquisition Data Book, Nat Inst.
[5] Digital Signal Analysis, Samuel D Stearns and Don R Hush, Prentice Hall Inc, 1990.

Prasyarat

Prerequisite(s)

EE184542 Sistem Elektronika Tertanam

EE184542 Embedded Electronic System

Mata Kuliah ***Course***	Nama MK *Name*	:	Perancangan Komponen Terprogram *Design Using Programmable Device*
	Kode MK *Core*	:	EE184643
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Fajar Budiman, ST, M.Eng
	Pengajar *Lecturer*	:	Fajar Budiman, ST, M.Eng Dr. Ir. Totok Mujiono M.Ilkom
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini mempelajari tentang implementasi rangkaian dan sistem digital menggunakan komponen hardware terprogram FPGA, yang juga meliputi prosedur perancangan menggunakan Bahasa HDL (*Hardware Description Language*) seperti VHDL atau Verilog, serta penggunakan EDA tools untuk perancangannya. Implementasi mencakup perancangan rangkaian kombinasional, rangkaian sekuensial, FSM, rangkaian DSP filter digital dan desain mikroprosesor.

This course studies the implementation of digital circuits and systems using programmable hardware components of FPGA, which also include design procedures using HDL (Hardware Description Language) such as VHDL or Verilog, and the use of EDA tools for designing. Implementation includes design of combinational circuits, sequential circuits, FSM, DSP, digital filter circuit, and microprocessor design.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-09) Mampu belajar mandiri untuk menumbuhkan kemampuan belajar sepanjang hayat

(PLO-09) Capable to learn independently to foster lifelong learning abilities

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Memahami rangkaian dan sistem digital untuk teknik perancangan dan klasifikasinya, ,emahami evolusi komponen H/W programmable, memahami arsitektur internal komponen H/W programmable seperti PLD dan FPGA serta kelebihan dan kekurangan masing-masing.

(CLO-01) Mastering digital circuits and systems for design and classification techniques, evolution of programmable H/W components, internal architecture of programmable H/W components such as PLD and FPGA and their respective advantages and disadvantages.

(CPMK-02) Memahami tahap-tahap perancangan sistem digital berbasis H/W programmable mulai dari spesifikasi yang diinginkan sampai testing, mampu melakukan perancangan sistem digital sederhana berbasis H/W programmable dengan metodologi yang benar. memahami teknik verifikasi serta penggunaannya

(CLO-02) Able to master the design stage of digital system based on H/W programmable ranging from the desired specification stage to testing stage, able to design a simple digital system based H/W programmable with the correct methodology, and able to understand the verification techniques and their usage.

(CPMK-03) Memahami EDA tools serta penggunaannya, seperti Quartus II untuk FPGA Altera

(CLO-03) Able to understand the EDA tools as well as their usage, such as Quartus II for Altera FPGA and Xilinx ISE

(CPMK-04) Mampu merancang sistem digital dan mengimplementasikan di dalam FPGA

(CLO-04) Able to design a digital system and implement in FPGA

(CPMK-05) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-05) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan

Main Subjects

1. Sistem Digital: kombinasional, sekuensial, Kontroler, data Path, Finite State Machine (FSM)

   Digital System: Combinational, Sequential, Controller, Data Path, Finite State Machine (FSM)
2. Evolusi dan Arsitektur komponen Hardware terprogram: PROM, PAL, PLA, Masked Gate Array, FPGA

   Evolution and Architecture of Programmed Hardware components: PROM, PAL, PLA, Masked Gate Array, FPGA
3. EDA Tools (Quartus Altera atau ISE Xilinx): Editing, Test bench, Synthesis, Place and route, Programming tools

   EDA Tools (Quartus Altera or Xilinx ISE): Editing, Test bench, Synthesis, Place and route, Programming tools
4. Desain teknik menggunakan HDL (VHDL atau verilog), meliputi Spesifikasi, pemilihan komponen, perancangan sistem, pembuatan entity dan arsitektur dengan metode persamaan logika/Boolean, data flow dan behavioral, verifikasi: Simulation, Timing analysis, implementasi dan test

   Technical design using HDL (VHDL or verilog), including Specification, component selection, system design, entity creation and architecture with logical/Boolean equation method, data flow and behavioral, verification: Simulation, Timing analysis, implementation and testing

5. Implementasi Rangkaian Kombinasional dan Rangkaian Sekuensial perancangan komponen terprogram ke dalam FPGA
   Implementation of Combinational and Sequential Circuits of programmable component design into FPGA
6. Implementasi Sistem Digital dan pengolahan sinyal digital (Digital Filter) perancangan komponen terprogram ke dalam FPGA
   Digital System Implementation and digital signal processing (Digital Filter) programmable component design into FPGA
7. Implementasi mikroprosesor (Control unit, datapath dan memory) perancangan komponen terprogram ke dalam FPGA
   Implementation of microprocessor (Control unit, datapath and memory) design of programmable components into FPGA

Pustaka

Reference(s)

[1] M Bob Zeidman, Designing with FPGAs and CPLDs, Elsevier, 2002
[2] Kevin Skahill, VHDL for Programmable Logic, Addison Wesley, 1996
[3] S. Brown and Z. Vranesic: Fundamentals of Digital Logic and VHDL Design, 3rd Edition McGraw-Hill, 2009.
[4] Enoch O. Hwang, Digital Logic and Microprocessor Design with VHDL, CL-Engineering, 2006 atau 2016 yang terbaru.
[5] M. Morris Mano and Charles R. Kimme, Logic and Computer Design Fundamentals, 4th edition, Pearson Prentice Hall, 2008.

Prasyarat

Prerequisite(s)

EE184401 Sistem Digital dan Mikroprosesor

EE184401 Digital and Microprocessor Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Elektronika Industri dan Robotika *Industrial Electronics and Robotics*
	Kode MK *Code*	:	EE184644
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VI (Wajib) *VI (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Djoko Purwanto, M.Eng
	Pengajar *Lecturer*	:	Fajar Budiman, ST, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Pada mata kuliah ini, mahasiswa akan mempelajari konsep sistem SCADA di industri beserta komponen - komponen penyusunnya yang meliputi sistem instrumentasi, pengontrol dan strategi kontrol, sistem penggerak serta jaringan komunikasi data elektronik di industri. Mahasiswa mempelajari sistem robotika di industri yang meliputi pengenalan dan aplikasi robot industri, kinematika robot, perencanaan gerak robot, pemrograman robot industri, kontrol robot, dan robot industri dalam CIM (*Computer Integrated Manufacture*).

In this course, students will study the concept of SCADA system in the industry along with its constituent components which include instrumentation system, controller and control strategy, drive system as well as electronic data communication network in industry. Students study industrial robotics systems that include the introduction and application of industrial robots, robotic kinematics, robot motion planning, industrial robot programming, robot control, and industrial robots in CIM (Computer Integrated Manufacture).

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep sistem elektronika pada sistem Supervisory Control and Data Acquisition (SCADA) beserta perangkat elektronik penyusunnya, dan menguasai sistem robotika di industri.

(CLO-01) Mastering the concept of electronics systems on Supervisory Control and Data Acquisition (SCADA) systems and their constituent electronic devices, and mastering robotics systems in the industry.

(CPMK-02) Mampu mendisain dan menganalisis sistem elektronika pada sistem Supervisory Control and Data Acquisition (SCADA) beserta perangkat elektronik penyusunnya, dan mampu mengimplementasikan sistem robotika di industri.

(CLO-02) Able to design and analyze electronics system in Supervisory Control and Data Acquisition (SCADA) system and its electronic device, and able to implement robotics system in industry.

(CPMK-03) Mampu menganalisis dan mengambil keputusan dalam menyelesaikan masalah terkait sistem elektronika dan robotika di industri.

(CLO-03) Able to analyze and take decisions in solving problems related to electronics and robotics systems in the industry.

(CPMK-04) Mampu bekerja secara mandiri dan kelompok dalam melaksanakan tugas dan tanggung jawabnya.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan

Main Subjects

1. Konsep sistem Supervisory Control and Data Acquisition (SCADA) dan komponen penyusunnya.
   The concept of Supervisory Control and Data Acquisition (SCADA) systems and their constituent components.
2. Piping and instrumentation diagram (P&ID) dan standar teknik pada sistem elektronika di Industri.
   Piping and instrumentation diagrams (P&ID) and engineering standards on electronic systems in the industry.
3. Sistem elektronika pada proses instrumentasi dan sistem penggerak di industri.
   Electronics systems in the process of instrumentation and the driving system in the industry.
4. Sistem elektronika komunikasi data antar perangkat penyusun sistem SCADA dan Protokol komunikasi di Industri.
   Electronic data communication system between SCADA system and communication protocol in industry.
5. Sistem elektronika pada perangkat pengendali dan jenis strategi pengendalian di industri.
   Electronic systems in controlling devices and types of control strategies in the industry.
6. Programmable Logic Controller (PLC)
   Programmable Logic Controller (PLC)
7. Perencanaan dan analisis sistem elektronika pada pengendalian umpan balik di Industri.
   Planning and analysis of electronic systems on feedback control in the Industry.
8. Pengenalan dan aplikasi robot di industry

Introduction and application of robots in industry

9. Kinematika robot industry
   Kinematics of industrial robots
10. Perencanaan gerak robot industri dan pemrograman robot industry
    Industrial robot motion planning and industrial robot programming
11. Kontrol robot industri dan implementasi robot industri dalam CIM (Computer Integrated Manufacture)
    Control of industrial robots and implementation of industrial robots in CIM (Computer Integrated Manufacture)

Pustaka

Reference(s)

[1] Timothy J. Maloney (2011). Modern IndustrialElectronics, 4/E, Prentice-Hall, Inc.
[2] Bartelt, T. L. (2011). Industrial automated systems: instrumentation and motion control. Clifton Park, NY: Delmar.
[3] Bruno Siciliano, dkk, Robotics: Modeling, Planning and Control, Springer-Verlag Limited, 2009.
[4] Appin Knowledge Solution, Robotics, Infinity Science Press, 2007.
[5] Lung-Wen Tsai, Robot Analysis, John Wiley and Sons, Inc., 1999.

Prasyarat

Prerequisite(s)

- EE184542 Sistem Elektronika Tertanam
  EE184542 Embedded Electronic System
- EE184543 Sensor dan Aktuator
  EE184543 Sensors and Actuators

Mata Kuliah ***Course***	Nama MK *Name*	:	Lab. Sistem Elektronika Terpadu *Integrated Electronic Systems Lab.*
	Kode MK *Code*	:	EE184741
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	VII (Wajib) *VII (Compulsory)*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Mohammad Rivai, ST, MT
	Pengajar *Lecturer*	:	Dr. Mohammad Rivai, ST, MT Dr. Ronny Mardiyanto, ST, MT Dr. Ir. Totok Mujiono, M.Ilkom
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Lab. Sistem Elektronika Terpadu membahas tentang proses analisis, simulasi, praktikum, dan perancangan Sistem Elektronika Analog meliputi Linear & Non-Linear Amplifiers, Oscillator & Small Signal Rectifier, DC to DC converters, Active Filter, Analog-Digital converter, dan Field Programmable Analog Array; Sistem Elektronika Tertanam meliputi: Sistem Digital meliputi Bahasa pemrograman hardware seperti VHDL atau Verilog, penggunakan EDA tools untuk perancangannya, Implementasi pada FPGA yang mencakup perancangan rangkaian kombinasional, rangkaian sekuensial, FSM, rangkaian DSP filter digital dan desain mikroprosesor.

The course of Integrated Electronics System Lab. discusses the analytical, simulating, practicum, and design process of Analog Electronic Systems including Linear & Non-Linear Amplifiers, Oscillators & Small Signal Rectifiers, DC to DC converters, Active Filters, Analog-Digital converters, and Field Programmable Analog Arrays; Embedded Electronics Systems; Design using Programmable Device include: hardware programming languages such as VHDL or Verilog, use of EDA tools for design, Implementation on FPGA that includes the design of combinational circuits, sequential circuits, FSM, DSP digital filter circuit and microprocessor design.

CPL Prodi yang Dibebankan

Learning Outcomes

PENGETAHUAN

KNOWLEDGE

(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-02) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-07) Capable to communicate effectively both in written and oral form

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, saling menghormati.

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai pengetahuan faktual tentang teknologi terbaru rangkaian elektronika analog dan digital serta pemanfaatannya pada sistem elektronika terpadu.

(CLO-01) Mastering factual knowledge about the latest technology of analog and digital circuitry and its use in integrated electronics system.

(CPMK-02) Mampu memanfaatkan perangkat analisis dan perancangan rekayasa berbasis teknologi elektronika analog dan digital yang sesuai dalam melakukan aktivitas rekayasa pada sistem elektronika terpadu.

(CLO-02) Able to utilize analytical and engineering tools based on appropriate analog and digital electronics technology in conducting engineering activities on integrated electronics systems.

(CPMK-03) Mampu bertanggungjawab atas pencapaian hasil kerja kelompok yang mencakup proses analisis, simulasi, praktikum dan perancangan sistem elektronika terpadu.

(CLO-03) Able to be responsible for the achievement of group work that includes the process of analysis, simulation, practicum and design of integrated electronic systems.

(CPMK-04) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki yang berkenaan dengan proses analisis, simulasi, praktikum dan perancangan sistem elektronika terpadu.

(CLO-04) Working together to make the most of his/her potential concerning to the process of analysis, simulation, practicum and design of integrated electronic systems.

Topik/Pokok Bahasan

Main Subjects

1. Linear & Non-Linear Amplifiers
   Linear & Non-Linear Amplifiers
2. Oscillator & Small Signal Rectifier
   Oscillator & Small Signal Rectifier
3. DC to DC converters
   DC to DC converters
4. Active Filter
   Active Filter
5. Analog-Digital converter
   Analog-Digital converter
6. Field Programmable Analog Array
   Field Programmable Analog Array
7. Perancangan sistem elektronika analog
   Design of analog electronic systems
8. Sistem Elektronika Tertanam
   Embedded Electronics System
9. VHDL/Verilog dan EDA Tools
   VHDL / Verilog and EDA Tools
10. Rangkaian kombinasional di FPGA
    Combinational circuit in FPGA
11. Rangkaian Sekuensial di FPGA

Sequential Circuits in FPGA

12. Tatap muka dan display dengan FPGA
    Face to face and display with FPGA
13. Filter Digital (FIR) di FPGA
    Digital Filters (FIR) in FPGA
14. Mikroprosesor di FPGA
    Microprocessor in FPGA

Pustaka

Reference(s)

[1] Petunjuk Lab. Sistem Elektronika Terpadu, 2018

[1] Instructions of Integrated Electronic Systems Lab., 2018

Prasyarat

Prerequisite(s)

- EE184541 Perancangan Sistem Elektronika Analog
  EE184541 Design of Analog Electronic Systems
- EE184542 Sistem Elektronika Tertanam
  EE184542 Embedded Electronic System
- EE184643 Perancangan Komponen Terprogram
  EE184643 Design Using Programmable Device

MATA KULIAH PILIHAN *(ELECTIVE COURSES)*

Mata Kuliah ***Course***	Nama MK *Name*	:	Desain dan Instalasi Tenaga Listrik* *Power System Design and Installation*
	Kode MK *Code*	:	EE184810
	Kredit *Credits*	:	4 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu *Lectures : 4 x 50 = 200 min/week* *Exercises/Assignments : 4 x 60 = 200 min/week* *Self learning : 4 x 60 = 240 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Margo Pujiantara, MT
	Pengajar *Lecturer*	:	Dr. Ir. Margo Pujiantara, MT Ir. Sjamsjul Anam, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	A student must have attended at least 75% of the lectures to sit in the exams

Deskripsi Mata Kuliah

Description of Course

Pada mata kuliah ini mahasiswa melakukan tahapan-tahapan dalam desain sistem elektrikal dan mekanikal pada distribusi kelistrikan rumah, gedung dan industri. Mahasiswa belajar menghitung dan menentukan spesifikasi peralatan, teknik pencahayaan dan sistem proteksi yang dipakai. Selain itu mahasiswa juga dikenalkan pada beberapa standar yang sering dipakai dalam melakukan desain sistem kelistrikan.

In this course students perform step by step in the design of electrical and mechanical systems in the electrical distribution of homes, buildings and industries. Students learn to calculate and determine the equipment specifications, lighting techniques and protection systems used. In addition, students are also introduced to several standards that are often used in electrical system design.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep dan prinsip rekayasa untuk merencanakan instalasi gedung dan industri. Mempelajari dan memahami permasalahan kelistrikan di industri. Merencanakan sistem kelistrikan untuk industri, teknik pencahayaan serta mampu menyempurnakan kualitas kelistrikan di industri.

(CLO-01) Mastering the concept and principles of engineering to plan the installation of buildings and industries. Learn and understand electrical problems in the industry. Planning electrical system for industry, lighting technique and able to improve the power quality in the industrial.

(CPMK-02) Mampu menganalisis instalasi gedung dan industri. Mempelajari dan memahami permasalahan kelistrikan di industri. Merencanakan sistem kelistrikan untuk industri, teknik pencahayaan serta mampu menyempurnakan kualitas kelistrikan di industri.

(CLO-02) Able to analyze the installation of buildings and industries. Learn and understand electrical problems in the industry. Planning electrical system for industry, lighting technique and able to improve the power quality in industrial.

(CPMK-03) Mampu menggunakan software ETAP, AutoCad untuk menganalisis instalasi gedung dan industri. Mempelajari dan memahami permasalahan kelistrikan di industri. Merencanakan sistem kelistrikan untuk industri, teknik pencahayaan serta mampu menyempurnakan kualitas kelistrikan di industri.

(CLO-03) Able to use ETAP software, AutoCad to analyze building and industrial installations. Learn and understand electrical problems in the industry. Planning electrical system for industry, lighting technique and able to improve electrical quality in industry.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Shows a responsible attitude towards the work in the field expertise independently.

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

(CLO-05) Working together to be able to take full advantage of their potential.

Topik/Pokok Bahasan

Main Subjects

1. Menggambar instalasi
   Installation Drawing
2. Menghitung kebutuhan peralatan instalasi listrik dan pencahayaan yang digunakan.

   Calculate the needs of electrical installation equipment and lighting used.
3. Merencanakan sistem distribusi listrik industri, Memodelkan, menyimulasikan dan menganalisis sistem kelistrikan di industri.
   Planning industrial electricity distribution system, Modeling, simulating and analyzing electrical system in industry.

4. Pemilihan peralatan yang disesuaikan dengan kebutuhan dan lingkungan industri, design sistem pengaman, sistem pentanahan, perbaikan power quality akibat beban industri dan gangguan luar.
   Selection of equipment to the needs and industrial environment, design of protection systems, grounding systems, power quality improvement due to industrial load and external disturbance.

Pustaka

Reference(s)

[1] Ir. E. Setiawan,Instalasi Tenaga Listrik arus Kuat, I, II, III, PUIL 2000
[2] Toran Gonen, Electric Power Distribution System Engineering, Mc.Graw-Hill.
[3] Irwin Lazar, Electrical System Analysis and Design for Industrial Plants, Mc.Graw-Hill.
[4] Wilson E. Kazibwe, Musoke H. Sendaula, Electrical Power Quality Control Techniques, Van Nostrand Reinhold, 1993

Prasyarat

Prerequisite(s)

- EE184511 Analisis Sistem Tenaga
  EE184511 Power System Analysis
- EE184710 Sistem Pengaman Tenaga Listrik
  EE184710 Power System Protection

Mata Kuliah ***Course***	Nama MK *Name*	:	Pengaman Sistem Tenaga Listrik* *Power System Protection*
	Kode MK *Code*	:	EE184710
	Kredit *Credit*	:	2 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 2 x 50 = 100 menit/minggu Latihan/tugas : 2 x 60 = 120 menit/minggu Belajar mandiri : 2 x 60 = 120 menit/minggu *Lectures : 2 x 50 = 100 min/week* *Exercises/Assignments : 2 x 60 = 120 min/week* *Self learning : 2 x 60 = 120 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Dimas Anton Asfani, ST, MT
	Pengajar *Lecturer*	:	Dr. Dimas Anton Asfani, ST, MT Dr. Dimas Fajar Uman Putra, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Pengaman Sistem Tenaga Listrik membahas tentang jenis peralatan pengaman atau relay protection, setting dan applikasinya pada sistem tenaga listrik.

Electric Power System Protection course discuss about the types of protection equipment or relay protection, its settings and applications in the electric power system.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

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

(PLO-11) Capable to identify, formulate and solve problems in the field of electrical engineering

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep prinsip dasar sistem proteksi, komponen sistem pengaman dan cara penentuan setting relay pengaman serta dapat menjelaskan dan menganalisis kordinasi proteksi.

(CLO-01) Mastering the concept of the basic principles of protection systems, protection system components and know how to determine protection relay settings and able to explain and analyze protection coordination.

(CPMK-02) Mampu menjelaskan proses terjadinya petir, mengetahui kerusakan yang diakibatkan sambaran petir dan mengetahui macam-macam metode proteksi petir serta mampu merencanakan proteksi petir dan mengkoordinasi isolasinya dalam sistem tenaga listrik.

(CLO-02) Able to explain the process of lightning, find out the damage caused by lightning strikes and know the various methods of lightning protection and are able to plan lightning protection and coordinate its isolation in the electric power system.

(CPMK-03) Mampu menganalisis komponen sistem pengaman dan cara penentuan setting relay pengaman serta dapat menjelaskan dan menganalisis kordinasi proteksi.

(CLO-03) Able to analyze protection system components and know how to determine protection relay settings and able to explain and analyze protection coordination.

(CPMK-04) Mampu menjelaskan proses terjadinya petir, mengetahui kerusakan yang diakibatkan sambaran petir dan mengetahui macam-macam metode proteksi petir serta mampu merencanakan proteksi petir dan mengkoordinasi isolasinya dalam sistem tenaga listrik.

(CLO-04) Able to explain the process of lightning, find out the damage caused by lightning strikes and know the various methods of lightning protection and are able to plan lightning protection and coordinate its isolation in the electric power system.

(CPMK-05) Mampu menggunakan software ETAP untuk menganalisis komponen sistem pengaman dan cara penentuan setting relay pengaman serta dapat menjelaskan dan menganalisis kordinasi proteksi.

(CLO-05) Able to use ETAP software to analyze security system components and how to determine protection relay settings and can explain and analyze protection coordination.

(CPMK-06) Mampu menggunakan software ATP/EMTP terjadinya petir, mengetahui kerusakan yang diakibatkan sambaran petir dan mengetahui macam-macam metode proteksi petir serta mampu merencanakan proteksi petir dan mengkoordinasi isolasinya dalam sistem tenaga listrik.

(CLO-06) Able to use ATP/EMTP software for lightning, find out the damage caused by lightning strikes and know the various methods of lightning protection and are able to plan lightning protection and coordinate its isolation in the power system.

(CPMK-07) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-07) Demonstrate an attitude of responsibility for work in the field expertised independently.

(CPMK-08) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.

(CLO-08) Working together to make use of their maximum potential.

Topik/Pokok Bahasan
Main Subjects

1. Gangguan-gangguan sistem tenaga listrik, persyaratan rele pengaman, peralatan transformator, fungsi dan elemen sistem

pengaman, macam-macam rele pengaman dan sistem pengamanannya.
Electrical power system disturbances, protection relay requirements, transformer equipment, protection system functions and elements, various protection relays and their security systems.

2. Perhitungan setting rele pengaman serta koordinasinya dalam sistem tenaga listrik; macam-macam sistem pengetanahan serta koordinasinya dengan sistem pengaman.
Calculation of the setting of Protection relay and its coordination in the electric power system; various sorting systems and their coordination with protection systems.
3. Pembentukan petir dan parameter petir; Kerusakan dan gangguan karena petir baik langsung atau tidak langsung (galvanic, induktive, capasitive); gelombang berjalan, EMC (*Electromagnetic Compability*).
Forming lightning and lightning parameters; Damage and interference due to lightning either directly or indirectly (galvanic, inductive, capacitive); traveling wave, EMC (Electromagnetic Compability).
4. Metoda sistem proteksi kerucut, sangkar farady, bola gelinding; Proteksi internal peralatan yang ada di gedung. Untuk sarana electrical, komputer, telekomunikasi, instrumentasi dan instalasi; pengaruh dan proteksi petir pada sistem tenaga listrik, dan koordinasi isolasi dalam sistem tenaga listrik.
The cone protection system method, Faraday cage, rolling ball; Internal protection of equipment in the building. For electrical, computer, telecommunications, instrumentation and installation facilities; the influence and protection of lightning on electric power systems, and coordination of isolation in electric power systems.

Pustaka

Reference(s)

[1] M. Titarenko & I.Noskov, Protective Relaying in Electric Power System,
[2] Sunïl S. Rao, Switchgear and Protection,

[3] Turan Gonen, Modern Power System Analysis,
[4] T.S. Hutauruk, Gelombang Berjalan dan Proteksi Surja
[5] Pritindra Chowdhuri, Electromagnetic Transient in Power System

Prasyarat ***Prerequisite(s)***
EE184511 Analisis Sistem Tenaga *EE184511 Power System Analysis*

Mata Kuliah ***Course***	Nama MK *Name*	:	Operasi Optimum Sistem Tenaga Listrik *Optimum Operation of Power System*
	Kode MK *Code*	:	EE184910
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Rony Seto Wibowo, ST, MT
	Pengajar *Lecturer*	:	Dr. Rony Seto Wibowo, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah optimal operasi sistem tenaga listrik membahas topik tentang penjadualan dan pembebanan pembangkit secara optimal ekonomi. Pembebanan pembangkit secara optimal dilakukan dengan mempertimbangkan batasan pasokan energi primer dan batasan jaringan seperti tegangan dan kapasitas saluran. Selain itu, mata kuliah ini juga membahas koordinasi antara pembangkit tenaga panas (thermal) dan pembangkit tenaga air (Hydro) dalam memasok beban. Beberapa metode konvensional dan metode cerdas diperkenalkan untuk menyelesaikan permasalahan.

The optimal course of operating the electric power system addresses the topic of optimal scheduling and loading of the economy. Optimal loading of plants is carried out by considering the limits of primary energy supply and network constraints such as channel voltage and capacity. In addition, this course also discusses coordination between thermal and hydro power plants in supplying loads. Some conventional methods and smart methods are introduced to solve problems.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro
(PLO-05) Capable to apply methods, ICT, and modern devices in solving problems in the field of electrical engineering

(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 pembebanan dan penjadualan optimum pembangkit listrik.

(CLO-01) Mastering the concept of loading and generating electricity optimum scheduling.

(CPMK-02) Mampu menganalisis kebutuhan beban dan mengatur pembebanan dan penjadualan unit pembangkit.

(CLO-02) Able to analyze load requirements and arrange loading and scheduling of generating units.

(CPMK-03) Mampu menggunakan software Matlab/ Powergen untuk menganalisis kebutuhan beban, pembebanan dan penjadualan unit pembangkit.

(CLO-03) Able to use Matlab / Powergen software to analyze load requirements, loading and scheduling generating units.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

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

(CLO-05) Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan

Main Subjects

1. Tujuan analisis keandalan sistem tenaga listrik (STL). Overview Sistem interkoneksi Jawa Bali. Perencanaan operasi STL di PLN P3B. Standard keandalan di Indonesia. Kurva heat rate, harga bahan bakar, kandungan kalori dalam bahan bakar.

   The purpose of the analysis of the reliability of the electric power system (STL). Overview of the Java Bali interconnection system. Planning for STL operations at PLN P3B. Reliability standards in Indonesia. Heat rate curve, fuel price, calorie content in fuel.
2. Formula economic dispatch tanpa rugi-rugi, Persamaan Lagrange, Metode analytic, Metode iterasi lambda.
   Economic dispatch formula without losses, Lagrange equation, Analytical method, Lambda iteration method.
3. Economic dispatch dengan base point dan participation factor.
   Economic dispatch with base point and participation factor.
4. Economic Dispatch mempertimbangan ramp rate atau disebut Dynamic Economic Dispatch.
   The Economic Dispatch considers the ramp rate or called Dynamic Economic Dispatch.
5. Matrix rugi-rugi saluran, Bmn.
   Matrix of channel losses, Bmn.
6. Formula economic dispatch dengan rugi-rugi saluran, Persamaan Lagrange, Metode iterasi lambda.
   Economic dispatch formula with channel losses, Lagrange equation, lambda iteration method.
7. Economic dispatch untuk fungsi biaya yang tdk kontinyu.
   Economic dispatch for non-continuous cost functions.
8. Formula dan perhitungan dynamic economic dispatch.
   Formula and economic dispatch dynamic calculations and calculations.
9. Spinning reserve, batasan unit thermal. Formula unit commitment. Metode daftar prioritas, Metode Dynamic Programming

   Spinning reserve, limitation of thermal units. Formula unit commitment. Priority list method, Dynamic Programming Method.

Pustaka

Reference(s)

[1] Power Generation Operation and Control (Allen J. Wood & Bruce F. Wollenberg), 2014
[2] Power System Analysis (Hadi Saadat)

Prasyarat

Prerequisite(s)

EE184511 Analisis Sistem Tenaga

EE184511 Power System Analysis

Mata Kuliah ***Course***	Nama MK *Name*	:	Fenomena Transien Tegangan Tinggi *High Voltage Transient Phenomena*
	Kode MK *Code*	:	EE184911
	Kredit *Credit*	:	3 sks
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. I Gusti Ngurah Satriyadi Hernanda, ST, MT
	Pengajar *Lecturer*	:	Dr. I Gusti Ngurah Satriyadi Hernanda, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	A student must have attended at least 75% of the lectures to sit in the exams

Deskripsi Mata Kuliah

Description of Course

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.

Transient high voltage phenomena discuss about transient phenomenon that may occur in the electric power system, especially in high voltage, such as: switching, lightning and transients with fast duration (less than 1 second). The discussion includes the symptoms of the emergence of phenomenon, causes, impacts on electrical equipment and human safety to the general prevention methods.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-06) Mampu mematuhi hukum dan perataruran yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-07) Capable to communicate effectively both in written and oral form

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep kejadian transien pada sistem tenaga listrik, penyebab, dampak, serta faktor yang mengakibatkan gejala transien tersebut.

(CLO-01) Mastering the concept of transient events in the electric power system, causes, impacts, and factors that cause these transient symptoms.

(CPMK-02) Mampu mendeskripsikan peneyelesaian permasalahan fenomena transien tegangan tinggi dalam sistem tenaga listrik.

(CLO-02) Able to describe the problem solving of high voltage transient phenomenon in electric power systems.

(CPMK-03) Mampu menerapkan perhitungan dan perancangan perlindungan peralatan tenaga listrik tegangan tinggi terhadap gangguan akibat fenomena transien.

(CLO-03) Able to calculate and design protection of high voltage electrical equipment to interference due to transient phenomenon.

(CPMK-04) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.

(CLO-04) Working together to make use of their maximum potential.

Topik/Pokok Bahasan

Main Subjects

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
   The concept and classification of transient phenomenon in electric power systems
3. Prinsip kerja Circuit Breaker (CB) dan fenomena switching
   The working principle of Circuit Breaker (CB) and switching phenomenon
4. Proses terjadinya fenomena petir dan sistem proteksi terhadap petir
   The process of the phenomenon of lightning and the protection system against lightning
5. Shielding failure dan back flashover
   Shielding failure and back flashover
6. Travelling wave
   Traveling wave
7. Proteksi peralatan tegangan tinggi dan gardu induk
   Protection of high voltage equipment and substations
8. Prinsip kerja surge arrester
   Working principle of surge arresters
9. Fenomena inrush current, ferroresonance.
   Inrush current, Ferro resonance phenomenon.
10. Simulasi transien dengan software EMTP/ATPDraw
    Transient simulation with EMTP / ATPDraw software.

Pustaka

Reference(s)

[1] Negara, I Made Yulistya, "Teknik Tegangan Tinggi; Prinsip dan Aplikasi Praktis", Graha Ilmu, Yogyakarta, 2013
[2] Martinez-Velasco, Juan, "Transient Analysis of Power Systems: Solution Techniques, Tools, and Applications", IEEE Press, 2015
[3] Ametani, Akihiro, et.al, "Power System Transients: Theory and Applications", CRC Press, 2017
[4] JC. Das, "Transients in Electrical Systems: Analysis, Recognition, and Mitigation", McGraw-Hill, 2010

[5] Su, Charles Q, "Electromagnetic Transients in Transformer and Rotating Machine Windings", IGI Global, 2013

Prasyarat

Prerequisite(s)

EE184513 Teknik Tegangan Tinggi

EE184513 High Voltage Engineering

Mata Kuliah ***Course***	Nama MK *Name*	:	Penggunaan dan Pengemudian Motor Listrik *Electric Motor Drive and Application*
	Kode MK *Code*	:	EE184912
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Feby Agung Pamuji, ST, MT
	Pengajar *Lecturer*	:	Dr. Feby Agung Pamuji, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Penggunaan dan Pengemudian Motor Listrik merupakan matakuliah yang membahas penggunaan motor listrik (ac / dc) dan perhitungan gaya, torque dan daya (HP) yang sesuai dengan karakteristik beban mekanik. Selain itu, mata kuliah ini memberikan pengetahuan mengenai konsep kendali kecepatan motor, torque motor, pengereman serta penerapannya di industri.

Electric Motor Drive and Application course discuss about the use of an electric motor (ac/dc) and the calculation of force, torque and power (HP) that are in accordance with the characteristics of mechanical loads. In addition, this course provides knowledge about the concepts of motor speed control, torque motors, braking and its application in the industry.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 dari penggunaan, metoda starting, kendali kecepatan dan torque serta metoda pengereman dari motor listrik sebagai penggerak beban mekanik.

(CLO-01) Mastering the concepts of use, starting methods, speed control and torque and braking methods of an electric motor as a driving force for mechanical loads.

(CPMK-02) Mampu menganalisis dalam pemilihan/penggunaan, metoda starting, kendali kecepatan dan torque serta metoda pengereman dari motor listrik yang berkaitan dengan beban mekanik yang digerakkan.

(CLO-02) Able to analyze the selection/use, starting method, speed control and torque and braking method of the electric motor that is related to the mechanical load that is driven.

(CPMK-03) Mampu menunjukkan kinerja mandiri, bermutu, dan terukur dalam menganalisis permasalahan dalam penggunaan dan pengemudian motor listrik.

(CLO-03) Able to show independent, quality and measurable performance in analyzing problems in the use and driving of electric motors.

(CPMK-04) Mampu bertanggungjawab atas hasil kerja, baik secara individu maupun kelompok.

(CLO-04) Having responsibility in work, both individually and groups.

Topik/Pokok Bahasan
Main Subjects

1. Menentukan / menghitung torque beban mekanik
   Determine/calculate torque mechanical load
2. Menentukan / menghitung daya motor (HP)
   Determine/calculate motor power (HP).
3. Menurunkan arus mula / starting.
   Reducing the starting current.
4. Metoda kendali kecepatan / torque
   Speed/torque control method
5. Metode pegereman
   Breaking method
6. Studi kasus pada penggerak; conveyor, mixer, crane, pompa serta mobil listrik dan kereta listrik.
   Case studies on motor drives, such as; conveyors, mixers, cranes, pumps and electric cars and electric trains.

Pustaka
Reference(s)

[1] Austin Hughes, “Electric Motors and Drives (Fundamental, Types and Applications)” 3th edition, 2006
[2] Piotr Wach, “Dynamics and Control of Electric Drives”, 2011

Prasyarat
Prerequisite(s)

- EE184512 Mesin Listrik
  EE184512 Electric Machines
- EE184611 Elektronika Daya
  EE184611 Power Electronics

Mata Kuliah ***Course***	Nama MK *Name*	:	Dinamika dan Stabilitas Sistem Tenaga Listrik *Dynamics and Stability of Power System*
	Kode MK *Code*	:	EE184913
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Prof. Dr. Ir. Imam Robandi, MT
	Pengajar *Lecturer*	:	Prof. Dr. Ir. Imam Robandi, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	A student must have attended at least 75% of the lectures to sit in the exams

Deskripsi Mata Kuliah

Description of Course

Mata kuliah Dinamika Sistem Tenaga Listrik membahas tentang stabilitas dinamik (steady state) dan sistem pengaturannya pada sistem tenaga listrik dari pusat sistem pembangkit tenaga listrik sampai ke beban.

Dynamics and stability of the power system course discuss about dynamic stability (steady state) and the regulatory system in the power system from the center of the power generation system to the load.

CPL Prodi yang Dibebankan

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 pemodelan sistem tenaga listrik untuk melakukan analisis stabilitas dinamik (steady state), dan mampu melakukan perbaikan dan inovasi dari sistem yang sudah dirancang.

(CLO-01) Mastering electric power system modeling to perform dynamic stability analysis (steady state), and able to make improvements and innovations from systems that have been designed.

(CPMK-02) Mampu melakukan pemodelan sistem tenaga dalam bentuk matematika dan dapat melakukan simulasi menggunakan bahasa paket pemrograman (Matlab, ETAP, atau Powerlib) untuk melakukan analisis kestabilan sistem.

(CLO-02) Able to do power system modeling in mathematical form and able to do simulations using programming package language (Matlab, ETAP, or Powerlib) to analyze system stability.

(CPMK-03) Mampu menunjukkan kinerja mandiri, bermutu, dan terukur dalam menganalisis permasalahan dinamika dan kestabilan sistem tenaga listrik.

(CLO-03) Able to demonstrate independent, quality and measurable performance in analyzing the dynamics and stability of the electricity system.

(CPMK-04) Mampu bertanggung jawab atas hasil kerja, baik secara individu maupun kelompok.

(CLO-04) Having responsibility in work, both individually and in groups.

Topik/Pokok Bahasan

Main Subjects

1. Matriks Khusus
   Special Matrix
2. State space
   State space
3. Kontrolabiliti, Observabiliti, dan Stabliti

Controllability, Observability, and Stability
4. Dasar-dasar Kestabilan
   Base of Stability
5. Model Linear SMIB
   Linear Model SMIB
6. Sistem Kontrol Eksitasi
   Excitation Control System
7. Power System Stabilizer
   Power System Stabilizer
8. Load Frequency Control
   Load Frequency Control
9. Osilasi Torsional
   Torsional Oscillation
10. Sistem Multimesin
    Multi Machine System

Pustaka

Reference(s)

[1] Imam Robandi, Modern Power System Control, Penerbit ANDI Yogyakarta, 2009.
[2] Imam Robandi, Desain Sistem Tenaga Modern, Penerbit Andi, Yogyakarta, 2006
[3] P. Kundur, Power System Stability, McGraw Hill, 1994
[4] P.M. Anderson and A.A. Fouad Fouad, Power System Control and Stability, John Wliey & Sons, Inc., 2003

Prasyarat

Prerequisite(s)

- EE184402 Dasar Sistem Tenaga Listrik
- *EE184402 Introduction to Power System*
- EE184513 Teknik Tengangan Tinggi
  EE184513 High Voltage Engineering

Mata Kuliah ***Course***	Nama MK *Name*	:	Kecerdasan Tiruan dalam Sistem Tenaga Listrik *Artificial Intelligence in Power System*
	Kode MK *Code*	:	EE184914
	Kredit *Credit*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Prof. Dr. Ir. Imam Robandi, MT
	Pengajar *Lecturer*	:	Prof. Dr. Ir. Imam Robandi, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Mata kuliah Kecerdasan Tiruan Dalam Sistem Tenaga Listrik membahas tentang berbagai macam Kecerdasan Tiruan (Artificial Intelligence, AI) yang digunakan sebagai alat untuk memperbaiki berbagai variabel Sistem Tenaga Listrik. *Artificial Intelligence in Electric Power Systems course discuss various kinds of Artificial Intelligence (AI) which are used as a tool to improve various variables of the Electric Power System.*
CPL Prodi yang Dibebankan ***Learning Outcomes***
(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro *(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering* (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 pemrograman untuk penyelesaian masalah sistem tenaga listrik menggunakan kecerdasan tiruan (Artificial Intelligence, AI).

(CLO-01) Mastering programming for solving power system problems using artificial intelligence (AI).

(CPMK-02) Menguasai penerapan AI pada sistem tenaga listrik, termasuk penguasaan bahasa pemrograman.

(CLO-02) Mastering the application of AI to electric power systems, including the feeling of programming languages.

(CPMK-03) Mampu menunjukkan kinerja mandiri, bermutu, dan terukur dalam menganalisis permasalahan dinamika dan kestabilan sistem tenaga listrik.

(CLO-03) Able to demonstrate independent, quality and measurable performance in analyzing the dynamics and stability of the electricity system.

(CPMK-04) Mampu bertanggung jawab atas hasil kerja, baik secara individu maupun kelompok.

(CLO-04) Having responsibility inwork, both individually and groups.

Topik/Pokok Bahasan

Main Subjects

1. Fuzzy Logic (FL)
   Fuzzy Logic (FL)
2. Neural Network (NN)
   Neural Network (NN)
3. Particle Swarm Optimization (PSO)
   Particle Swarm Optimization (PSO)
4. Genetic Algorithm (GA)
   Genetic Algorithm (GA)

Pustaka

Reference(s)

[1] Imam Robandi, Desain Sistem Tenaga Modern, Penerbit Andi, Yogyakarta, 2006
[2] Mohamad A El-Hawary, Anvanced Solutions in Power Systems, Wiley, 2016
[3] Kwang Y Lee and M. A. El Sharkawi, Wiley-Interscience, 2008
[4] Weerakorn Ongsakul and Dien Ngoe Vo, Artificial in Power System Optimization, CRE Press, 2013

Prasyarat
Prerequisite(s)

- EW184002 Dasar Pemrograman
  EW184002 Basic Programming
- EE184402 Dasar Sistem Tenaga Listrik
  EE184402 Introduction to Power System

Mata Kuliah ***Course***	Nama MK *Name*	:	Perencanaan Sistem Tenaga Listrik *Power System Planning*

	Kode MK *Code*	:	EE184915
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Rony Seto Wibowo, ST, MT
	Pengajar *Lecturer*	:	Dr. Rony Seto Wibowo, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini membahas kebijakan negara untuk memenuhi kebutuhan listrik sesuai dengan pertumbuhan beban listrik dan ketersediaan energi primer. Kebijakan ketenagalistrikan dikuti dengan perencanaan sistem tenaga listrik yang meliputi perencanaan sistem pembangkit, sistem transmisi dan sistem distribusi. Perencanaan ini diharapkan memenuhi standard keandalan sistem pembangkit seperti LOLE dan LOEE, serta keandalan sistem distribusi seperti SAIDI, SAIFI dan CAIFI.

This course discusses about state policies to meet electricity needs in accordance with the growth of electricity costs and the availability of primary energy. Electricity policy is followed by the planning of an electric power system which includes the planning of the power system, transmission system and distribution system. This plan is expected to meet the reliability standards of generating systems such as LOLE and LOEE, as well as the reliability of distribution systems such as SAIDI, SAIFI and CAIFI.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-06) Mampu mematuhi hukum dan perataruran yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai kebijakan ketenagalilstrikan nasional serta menguasai konsep keandalan sistem pembangkit dan sistem distribusi listrik.

(CLO-01) Mastering national electricity policies and mastering the concept of reliability of generating systems and electricity distribution systems.

(CPMK-02) Mampu merencanakan pengembangan sistem tenaga listrik dalam beberapa tahun ke depan untuk sistem pembangkit maupun sistem distribusi.

(CLO-02) Able to plan the development of electric power systems in the next few years for generating systems and distribution systems.

(CPMK-03) Mampu menerapkan ilmu di bidang probabilitas-statistik dan ilmu di bidang power untuk perencanaan sistem tenaga listrik.

(CLO-03) Able to apply knowledge in the field of probability-statistics and science in the field of power to plan electric power systems.

(CPMK-04) Mampu bertanggung jawab atas pekerjaan yang diberikan secara mandiri.

(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

(CPMK-05) Mampu bekerjasama dengan orang lain dalam menyelesaikan pekerjaan.

(CLO-05) Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan

Main Subjects

1. Kebijakan energi primer
   Primary energy policy
2. Kebijakan ketenagalistrikan
   Electricity policy
3. Indeks keandalan LOLP
   LOLP reliability index
4. Indeks keandalan EENS, EIR
   EENS reliability index, EIR
5. Indeks SAIDI, SAIFI, CAIDI, ASAI, ASUI
   SAIDI, SAIFI, CAIDI, ASAI, ASUI indexes
6. Metode Historical Data
   Historical Data Method
7. Metode Network Reduction
   Network Reduction Method
8. Metode FMEA
   FMEA Method

Pustaka

Reference(s)

[1] Marko Cepin, “Assessment of Power System Reliability: Methods and Applications”, Springer, 2011
[2] Roy Billington, Ronald N Allan, “Reliabiliy Evaluation of Engineering Systems”, Plenum Press : New York, 1992

[3] Roy Billington, Ronald N Allan, “Reliabiliy Evaluation of Power System”, Plenum Press : New York, 1996
[4] Rencana Usaha Penyediaan Tenaga Listrik (RUPTL)

Prasyarat

Prerequisite(s)

EE184511 Analisis Sistem Tenaga
EE184511 Power System Analysis

Mata Kuliah ***Course***	Nama MK *Name*	:	Kualitas Daya Listrik *Power Quality*
	Kode MK *Code*	:	EE184916
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Ni Ketut Aryani, MT
	Pengajar *Lecturer*	:	Dr. Ir. Ni Ketut Aryani, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini membahas tentang fenomena dan simulasi fenomena kualitas daya listrik pada sistem distribusi tenaga listrik, dengan bahasan meliputi: Definisi Kualitas Daya Listrik, Standards, Capacitor Bank untuk Koreksi Faktor Daya, Aliran Daya Reaktif dan Rugi-rugi Daya, Kualitas Tegangan, Ketakseimbangan, Harmonisa.

The course discusses the phenomena and simulations of the phenomenon of the quality of electric power in electric power distribution systems, with discussion covering: Definition of Quality of Electric Power, Standards, Capacitors Bank for Correction of Power Factors, Reactive Power Flow and Power Losses, Voltage Quality, Imbalances, and Harmonics.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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 fenomena kualitas daya listrik pada sistem distribusi tenaga listrik ac 3 fasa dalam keadaan steady state/transient dan simetri/tak simetri.

(CLO-01) Mastering the concept of the phenomenon of electric power quality in the 3 phase ac power distribution system in a steady state / transient and symmetrical / non-symmetrical state.

(CPMK-02) Mampu men-simulasi-kan fenomena kualitas daya listrik pada sistem distribusi tenaga listrik ac 3 fasa dalam keadaan steady state/transient dan simetri/tak simetri menggunakan software simulasi.
(CLO-02) Able to simulate the phenomenon of electric power quality in the 3 phase ac power distribution system in a steady state / transient and symmetry / non-symmetry using simulation software.

(CPMK-03) Mampu menggunakan software simulasi untuk melakukan simulasi fenomena kualitas daya pada sistem distribusi listrik tenaga listrik.
(CLO-03) Able to use simulation software to simulate power quality phenomena in electric power distribution systems.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahlian Kualitas Daya Listrik secara mandiri.
Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.
Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan
Main Subjects

1. Pengertian FENOMENA kualitas daya listrik, permasalahan akibat penurunan kualitas daya.
   Definition of PHENOMENA electric power quality, problems due to decreased power quality
2. DEFINISI KUALITAS DAYA LISTRIK & STANDARD : Transients, Short Duration Variations, Long Duration Variations, Voltage Imbalance, Waveform Distortions, Voltage Fluctuations, Power Frequency Variations
   POWER QUALITY DEFINITION & STANDARD: Transients, Short Duration Variations, Long Duration Variations, Voltage Imbalance, Waveform Distortions, Voltage Fluctuations, Power Frequency Variations

3. CAPACITOR BANK UNTUK KOREKSI FAKTOR DAYA : Pengertian Faktor Daya, Sumber Energi Reaktif, Keuntungan Teknis dan Ekonomis, Perhitungan Daya Capacitor Bank, Contoh Manfaat Perbaikan Faktor Daya
   CAPACITOR BANKS FOR CORRECTION OF POWER FACTORS: Understanding Power Factors, Reactive Energy Sources, Technical and Economic Benefits, Calculation of Bank Capacitor Power, Examples of Benefits of Power Factor Repair
4. ALIRAN DAYA REAKTIF DAN RUGI-RUGI DAYA : Aliran Daya Reaktif, Peralatan/Beban yg Menyerap Daya Reaktif, Rug-rugi Akibat Aliran Daya Reaktif, Kompensasi Daya Reaktif, Lokasi Kapasitor, Efek Samping Kompensasi Daya Reaktif.
   REACTIVE POWER AND POWER LOSS: Reactive Power Flow, Equipment / Load Absorbing Reactive Power, Rug-Loss Due to Reactive Power Flow, Reactive Power Compensation, Capacitor Location, Side Effects of Reactive Power Compensation.
5. KUALITAS TEGANGAN : Pengertian Gangguan Tegangan, Transients, Short Duration Variations, Long Duration Variations, Voltage Fluctuation (Flicker).
   VOLTAGE QUALITY: Definition of Voltage Interference, Transients, Short Duration Variations, Long Duration Variations, Voltage Fluctuation (Flicker).
6. KETAKSEIMBANGAN : Pengertian Ketakseimbangan, Penyebab Terjadinya Ketakseimbangan, Komponen Simetri, Indikator Ketakseimbangan, Dampak Ketakseimbangan terhadap Peralatan Listrik, Rekomendasi Praktis untuk Membatasi Ketakseimbangan, Memperbaiki Keseimbangan Jaringan Supply.
   BALANCE: Understanding Imbalance, Causes of Imbalance, Symmetry Components, Imbalance Indicators, Imbalance Impacts on Electrical Equipment, Practical Recommendations for Limiting Imbalances, Improving Supply Network Balance.
7. HARMONISA : Pengertian Harmonisa, Permasalahan Akibat Harmonisa, Bagaimana Mereduksi Harmonisa, Bagaimana Mendeteksi Harmonisa, Harmonisa Tegangan dan Arus pada Sistem Supply, Faktor Distorsi Harmonisa Tegangan dan Arus,

Sumber Arus Harmonisa, System Respons Characteristic, Efek dari Harmonisa, Kapasitor dan Harmonisa, Reduksi Arus Harmonisa, Standard Harmonisa.

HARMONICS: Understanding Harmonics, Problems Due to Harmonics, How to Reduce Harmonics, How to Detect Harmonics, Harmonics of Voltage and Flow in Supply Systems, Voltage and Current Harmonic Distortion Factors, Harmonics Flow Sources, System Characteristic Responses, Harmonics, Capacitors and Harmonics, Harmonics Flow Reduction, Standard Harmonics.

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] W. Mielcczarski, G.J. Anders, M.F. Conlon, W.B. Lawrence, H. Khalsa, G. Michalik, ”Quality of Electricity Supply & Management of Network Losses”, Puma Press, 1997
[2] Roger C. Dugan, Mark F.McGranagan, H. Wayne Beaty, ”Electrical Power Systems Quality”, McGraw Hill, 1996
[3] Wilson E. Kazibwe, Musoke H. Sendaula, ”Electric Power Quality Control Techniques”, Van Nostrand Reinhold, 1993

Prasyarat
Prerequisite(s)

EE184511 Analisis Sistem Tenaga
EE184511 Power System Analysis

Mata Kuliah ***Course***	Nama MK *Name*	:	Pemeliharaan Peralatan Listrik *Electrical Power Equipment Maintenance*
	Kode MK *Code*	:	EE184917
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Dimas Anton Asfani, ST, MT.
	Pengajar *Lecturer*	:	Dr. Dimas Anton Asfani, ST, MT.
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah ***Description of Course***
Matakuliah Pemeliharaan Peralatan Listrik membahas tentang strategi dan manajemen pemeliharaan secara umum (*Computerized Maintenance Management System* /CMMS), test DC dan AC pada isolasi peralatan listrik.Selain bahasan tersebut,di kuliah ini juga dibahas pengujian dan pemeliharaan peralatan sistem tenaga listrik yang mencakup peralatan listrik di pembangkit, gardu induk, transmisi dan distribusi termasuk Generator, Cable, Trafo, Switchgear, Circuit breaker, dan Motor. Selain materi teoritis diatas, praktek pengujian peralatan dan analisisnya akan dilakukan di laboratorium, termasuk pengukuran resistansi, induktansi dan kapasitansi belitan, tahanan isolasi, Polarisasi Index, Dielectrik Absorbtion Ratio, tahanan kontak, tahanan pentanahan dan HiPot test.Prosedur keselamatan, urutan kerja dan dokumentasi laporan juga dibahas. *Electrical Power Equipment Maintenance Courses discuss about management and maintenance strategy (Computerized Maintenance Management System / CMMS), DC and AC test in electrical equipment. In addition, this lecture also discussed the testing and maintenance of electric power system equipment in power plant, substations, transmission and distribution. The equipment including Generator, Cable, Transformer, Switchgear, Circuit breaker, and Motor. In addition, practical testing of the equipment and its analysis will be carried out in the laboratory. The practical testing in laboratory consist of the measurement of resistance, inductance and capacitance winding, isolation resistance, Polarization Index, Dielectric absorption ratio, contact resistance, grounding resistance and HiPot test. Procedure safety, work order and documentation reports are also discussed.*
CPL Prodi yang Dibebankan ***Learning Outcomes***
(CPL-02) Mampu merancang dan melaksanakan eksperimen laboratorium dan/atau lapangan, menganalisa dan menginterpretasi

data, serta menggunakan penilaian yang obyektif untuk menarik kesimpulan

(PLO-5) Capable to design and carry out laboratory and / or field experiments, analyze and interpret data, and use objective judgments to draw conclusions.

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-07) Capable to communicate effectively both in written and oral form

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep manajemen pemeliharaan peralatan, jenis test untuk setiap peralatan listrik, standard yang digunakan untuk evaluasi hasil test dan pemeliharaan.
(CLO-01) Mastering the concept of equipment maintenance management, the type of test for each electrical equipment, the standard used for evaluation of test results and maintenance.

(CPMK-02) Mampu mengoperasikan peralatan test listrik termasuk Mega Ohm meter, High Potensial Test, micro amperemeter, mili voltmeter, earth resistant meter, thermal imager.
(CLO-02) Able to operate electrical test equipment including Mega Ohm meter, High Potential Test, micro amperemeter, milli voltmeter, earth resistant meter, thermal imager.

(CPMK-03) Mampu menyusun laporan hasil pengujian peralatan dan melakukan evaluasi.
(CLO-03) Able to compile reports of equipment testing results and conduct evaluation.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-04) Demonstrate a responsible attitude towards the work in the field of expertise independently.

(CPMK-05) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-05) Working together to be able to take full advantage of their potential.

Topik/Pokok Bahasan
Main Subjects

1. Konsep CMMS dan Strategi Pemeliharaan peralatan listrik: bagaimana penentuan RTF, PM, PdM dan RCM
   CMMS Concept and Maintenance Strategy of Electrical Equipment: how to determine RTF, PM, PdM and RCM
2. Test DC untuk isolasi peralatan listrik: tahaan isolasi, PI, DAR
   DC test for electrical equipment isolation: isolation resistance, PI, DAR
3. Test AC untuk isolasi peralatan listrik : PF dan DF
   Test AC for electrical equipment insulation: PF and DF
4. Mode kegagalan dan pemeliharaan Motor Listrik
   Mode of failure and maintenance of Electric Motors
5. Mode kegagalan dan pemeliharaan Trafo
   Mode of failure and maintenance of the transformer
6. Mode kegagalan dan pemeliharaan Generator
   Mode failure and maintenance Generator
7. Mode kegagalan dan pemeliharaan Panel
   Mode of failure and maintenance of the Panel

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] Paul Gill, Electrical Power Equipment Maintenance and Testing, Second Edition, December 22, 2008 by CRC Press ISBN 9781574446562.
[2] Greg C. Stone, Ian Culbert, Edward A. Boulter, Hussein Dhirani, Electrical Insulation for Rotating Machines: Design, Evaluation, Aging, Testing, and Repair, 2nd Edition, July 2014, Wiley-IEEE Press, ISBN: 978-1-118-05706-3
[3] William A. Thue, Electrical Power Cable Engineering, Third Edition, December 13, 2011 by CRC Press, ISBN 9781439856437

Prasyarat
Prerequisite(s)

- EE184512 Mesin Listrik
  EE184512 Electric Machines
- EE184513 Teknik Tegangan Tinggi
  EE184513 High Voltage Engineering

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Energi Baru dan Terbarukan *Renewable Energy*
	Kode MK *Code*	:	EE184918
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Dedet Chandra Riawan, ST, M.Eng
	Pengajar *Lecturer*	:	Dr. Dedet Chandra Riawan, ST, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

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 global energy conditions and the role of new and renewable energy (RE) as an alternative energy source other than fossil fuel. Potential, conversion principles and characteristics of RE sources, especially photovoltaic, wind power, hydropower are explained through simple modeling. Components of the RE-based generation system are introduced in stand-alone, grid-connected, and hybrid topologies. This topology is discussed with a simple energy equilibrium analysis accompanied by a practical example. In this course is also given simple economic analysis such as Simple Payback Period, IRR, and NPV to calculate investment of RE-based generation system.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro
(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 potensi EBT dan menguasai prinsip konversi nya
(CLO-01) Understanding the potential of RE and master its conversion principle

(CPMK-02) Menguasai sistem pembangkitan EBT beserta komponen utamanya
(CLO-02) Understanding the system of generation of RE and its main components

(CPMK-03) Mampu membuat desain sistem pembangkitan EBT
(CLO-03) Able to design RE generation system

(CPMK-04) Mampu membuat analisis teknis dan ekonomis terhadap sistem pembangkitan EBT
(CLO-04) Able to make technical and economic analysis of RE generation system

(CPMK-05) Mampu menyusun laporan hasil pengujian peralatan dan melakukan evaluasi.
(CLO-05) Able to compile reports of equipment testing results and conduct evaluation.

(CPMK-06) Menunjukkan sikap bertanggung jawab terhadap pekerjaan di bidang keahliannya secara mandiri.

(CLO-06) Demonstrate a responsible attitude towards the work in the field of expertise independently.

(CPMK-07) Bekerja sama untuk dapat memanfaatkan potensi mereka secara maksimal.
(CLO-07) Working together to be able to take full advantage of their potential.

Topik/Pokok Bahasan
Main Subjects

1. Energi dunia dan peran EBT
   World energy and the role of RE
2. Spektrum cahaya matahari, semikonduktor sebagai sel surya, jenis dan teknologi sel surya
   The spectrum of sunlight, semiconductors as solar cells, types and technologies of solar cells
3. Single diode model untuk sel surya
   Single diode model for solar cell
4. Energi potensial air dan prinsip konversinya
   The potential energy of water and its conversion principle
5. Pembangkit listrik tenaga air skala kecil
   Small scale hydroelectric power plant
6. Energi potensial angin dan konversinya
   Wind potential energy and its conversion
7. Pemodelan turbin angin
   Modeling of wind turbines
8. Sistem pembangkitan skala kecil berbasis EBT dan penyimpan energi listrik
   Small-scale generation system based on RE and electric energy storage
9. Analisis biaya, Simple Payback Period, IRR, dan NPV pembangkitan berbasis EBT
   Cost analysis, Simple Payback Period, IRR, and NPV based generation of RE

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

10. *Final examination*

Pustaka
Reference(s)

[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

Prasyarat
Prerequisite(s)

EE184402 Dasar Sistem Tenaga Listrik
EE184402 Introduction to Power System

Mata Kuliah ***Course***	Nama MK *Name*	:	Manajemen Proyek dan Keselamatan Kerja *Project Management and Safety*
	Kode MK *Code*	:	EE184919
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Margo Pujiantara, MT
	Pengajar *Lecturer*	:	Dr. Ir. Margo Pujiantara, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah ***Description of Course***
Mata kuliah Manajemen Proyek dan Keselamatan Kerja mempelajari proses inisiasi proyek, proposal, lingkup pekerjaan, penjadwalan dan pembiayaan termasuk keselamatan kerja khususnya dibidang kelistrikan. *Project management courses and safety discuss about project initiation process, proposal, scope of work, scheduling and financing including safety in particular in the field of electricity.*
CPL Prodi yang Dibebankan ***Learning Outcomes***
(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial *(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.* (CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan *(PLO-07) Capable to communicate effectively both in written and oral form* (CPL-12) Mampu menunjukkan sikap religius, nasionalis, saling menghormati *(PLO-12) Capable to show religious, nationalist, and mutual respect characters*
Capaian Pembelajaran Mata Kuliah ***Course Learning Outcomes***
(CPMK-01) Mengetahui aplikasi dan kebutuhan sistem pengkonversi energi berbasis elektronik di lingkup sistem ketenaga-listrikan maupun masyarakat secara umum

(CLO-01) Knowing the applications and requirements of electronic-based energy conversion systems in the scope of electricity systems and society in general

(CPMK-02) Mengetahui perangkat pengkonversi energi beserta komponen utamanya
(CLO-02) Knowing the energy converter device as well as its main component

(CPMK-03) Mampu membuat desain sistem pengkonversi energi dan mampu membuat analisis teknis terhadap perangkat pengkonversi energi
(CLO-03) Able to design energy conversion systems and be able to make technical analysis of energy conversion devices

Topik/Pokok Bahasan
Main Subjects

1. Overview dan dasar-dasar pengertian proyek dan manajemen proyek
   Overview and basics of project understanding and project management
2. Metode-metode dan tata cara pembuatan RKS, BQ, dan proprosal penawaran sebuah proyek
   Methods and procedures for making RKS, BQ, and proposal projects
3. Langkah-langkah proses tender mulai dari pemasukan penawaran, anwijzing, penentuan pemenang
   The steps of the tender process start from bidding, aanwijzing, and determining the winner
4. Perhitungan prosentase kemajuan proyek dan pembuatan kurva S
   Calculating the percentage of project progress and making an S curve
5. Standar keselamatan kerja pada area-area bertegangan listrik
   Standards of work safety in electric voltage areas
6. Tata cara penyelamatan diri, peralatan-peralatan yang dipergunakan saat bekerja pada daerah bertegangan, pertolongan pertama pada kecelakaan kerja

Procedures for self-rescue, equipment used when working in a voltage area, first aid in workplace accidents

7. Menyusun prosedur urutan pekerjaan yang dilakukan dan mengerti potensi bahaya dan antisipasinya pada tiap urutan pekerjaan
   Arrange procedures for the sequence of work performed and understand potential hazards and their anticipation in each sequence of work

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
8. - *Final examination*

Pustaka
Reference(s)

[1] John M Nicholas, Herman Steyn, Project Management for Engineering, bussines and Technology, Routledge Press, 2012
[2] Adedeji B Badiru, Step Project Management, CRC Press, 2009
[3] Jhon Cadick, Mary C, Dennis K, Electrical Safety Handbook, Third Edition, Mc GRAW-HILL, 2006

Prasyarat
Prerequisite(s)

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Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Pengaturan Optimal *Optimal Control Systems*
	Kode MK *Code*	:	EE184920
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Ali Fatoni, MT
	Pengajar *Lecturer*	:	Ir. Ali Fatoni, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Sistem Pengaturan Optimal membahas tentang metode desain sistem pengaturan dengan kriteria minimum energi dan waktu. Permasalahan pengaturan yang dibahas meliputi persoalan regulator dan tracking dengan menggunakan hukum state feedback. Selain itu, state estimator juga dibahas untuk keperluan desain sistem menggunakan hukum state feedback apabila tidak semua state tersedia atau terukur.

The course discusses control system design methods using minimum energy and minimum time criteria. Control issues discussed include regulator and tracking issues using the law of state feedback. In addition, state estimators are also discussed for system design purposes using the law of state feedback if not all states are available or measurable.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate and solve problems in the field of electrical engineering

(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 dan prinsip sistem pengaturan optimal untuk analisis dan prosedur perancangan sistem dengan bantuan Matlab/Simulink.
(CLO-01) Mastering the concept and principle of the optimal control system based on quadratic performance index for regulator and tracking problems.

(CPMK-02) Mampu menyelesaikan masalah kendali optimal pada plant linier (nonlinier) untuk meminimlkan indeks performansi kuadratik dan merancang sistem kontrol optimal untuk plant nyata.
(CLO-02) Able to solve the optimal control problem for the linear (nonlinear) plant to minimize the quadratic performance index and to design an optimal control system for real plants.

(CPMK-03) Mampu melakukan simulasi komputer menggunakan MATLAB/Simulink.
(CLO-03) Able to do a computer simulation using MATLAB /Simulink.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri dan dapat bekerja sama dalam tim untuk memeroleh hasil rancangan sistem yang baik.
(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Optimisasi Statis
   Static Optimization
2. Kalkulus Variasi
   The Calculus of Variations
3. Linear Quadratic Regulator
   Linear Quadratic Regulator
4. Linear Quadratic Tracking
   Linear Quadratic Tracking
5. State Estimator
   State Estimator

6. Linear Quadratic Minimum-Time
   Linear Quadratic Minimum-Time

Pustaka
Reference(s)

[1] Frank L. Lewis, Vassilis L. Syrmos, “Optimal Control,” John Wiley & Sons Inc., New York, 1995
[2] Frank L. Lewis, “Applied Optimal Control and Estimation,” PHI, New Jersey, 1992
[3] Anderson,B.D.O., “Optimal Control: Linear Quadratic Methods,” PHI, New Jersey, 1989
[4] Trihastuti Agustinah, “Diktat Kuliah: Sistem Pengaturan Optimal,” Teknik Elektro ITS, 2018

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*

Prasyarat
Prerequisite(s)

EE184404 Dasar Sistem Pengaturan
EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Pengaturan Adaptif *Adapative Control Systems*
	Kode MK *Code*	:	EE184921
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	-
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	M. Abdul Hady, ST, MT
	Pengajar *Lecturer*	:	M. Abdul Hady, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata Kuliah Sistem Pengaturan Adaptif membahas tentang konsep sistem pengaturan adaptif, baik yang langsung (direct) maupun yang tidak langsung (indirect), model parametrik sistem dinamik, metode estimasi parameter, estimasi parameter nonrekursif dan estimasi parameter rekursif, validasi model, sistem adaptif model referensi (MRAC), sistem adaptif self tuning regulator (STR) dan sistem pengaturan adaptif fuzzy.

This course discusses the concepts and applications of adaptive control systems: direct and indirect adaptive control, dynamic system parametric models, parameter estimation methods, non-recursive parameter estimates and recursive parameter estimates, model validation, model reference adaptive control (MRAC), adaptive system for self tuning regulator (STR) and fuzzy adaptive control system.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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 sistem adaptif dalam persoalan sistem pengaturan.
(CLO-01) Mastering the concept of adaptive systems in control system issues.

(CPMK-02) Mampu memformulasikan persoalan kontrol adaptif dan menganalisa serta membuat simulasi sistem kontrol adaptif.
(CLO-02) Able to formulate adaptive control issues and analyze and simulate adaptive control systems.

(CPMK-03) Mampu menggunakan software Matlab/Simulink untuk melakukan visualisasi control adaptif.
(CLO-03) Able to use Matlab / Simulink software to visualize adaptive control.

(CPMK-04) Berusaha secara maksimal dalam kerjasama untuk mencapai hasil yang sempurna.
(CLO-04) Working together to be able to make the most of his/her potential.

Topik/Pokok Bahasan
Main Subjects

1. Konsep pengaturan adaptif
   The concept of adaptive control
2. Model parametrik sistem, estimasi parameter, validasi model.
   System parametric model, parameter estimation, model validation.
3. Sistem adaptif model reference (MRAC)
   Model Reference Adaptive Control (MRAC)
4. Sistem adaptif self-tuning (STR).
   Self-tuning Regulator (STR) adaptive system.
5. Sistem pengaturan adaptif stokastik
   Stochastic adaptive control system
6. Konsep kestabilan sistem adaptif
   The concept of adaptive system stability
7. Sistem pengaturan fuzzy adaptif

Fuzzy adaptive control system

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
8. - *Final examination*

Pustaka
Reference(s)

[1] Astrom, KJ and Wittenmark, B.: "Adaptive Control", Addison-Wesley, 1997
[2] Landau, ID,: "System Identification and Control Design", Prentice-Hall, 1990
[3] Tao, Gang, : " Adaptive Control, Design and Analysis", John Wiley & Sons, 2003
[4] Sastry, S. and Bodson,M: "Adaptive Control Stabliity, Convergence and Robustness", Prentice-Hall Advanced Reference Series, 1989

Prasyarat
Prerequisite(s)

EE184404 Dasar Sistem Pengaturan
EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Pengaturan Cerdas *Intelligent Control System*
	Kode MK *Code*	:	EE184922
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr.Ir. Ari Santoso, DEA
	Pengajar *Lecturer*	:	Dr.Ir. Ari Santoso, DEA
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Sistem Pengaturan Cerdas memelajari metode desain sistem pengaturan menggunakan metode pengaturan fuzzy dan neural network, dan optimisasi menggunakan genetic algorithm. Desain basis aturan dari sistem fuzzy tipe Mamdani maupun Sugeno menggunakan teknik heuristik. Model fuzzy Takagi-Sugeno digunakan untuk merepresentasikan dinamika dari sistem nonlinier dengan basis aturan untuk kontroler menggunakan konsep Parallel Distributed Compensation. Validasi desain sistem fuzzy diaplikasikan pada sistem nyata. Metode neural network juga dibahas dan digunakan untuk keperluan pengaturan sistem, sedangkan genetic algorithm digunakan untuk menyelesaikan persoalan optimisasi dalam sistem pengaturan.
Intelligent Control Systems studies the method of control systems design using fuzzy control and neural network, and optimization using genetic algorithm. Design of basic rules of fuzzy systems of the Mamdani and Sugeno types use heuristic method are discussed. The Takagi-Sugeno fuzzy model is used to represent the dynamics of a nonlinear system on the basis of rules for controllers using the concept of Parallel Distributed Compensation. Validation of fuzzy system design is applied to real systems. Neural network methods are also discussed and used for system control purposes, while genetic algorithms are used to solve optimization problems in the control system.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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 dan prinsip sistem kendali cerdas yaitu kendali fuzzy dan jaringan syaraf tiruan untuk analisis dan perancangan sistem nonlinier, dan algoritma genetika untuk keperluan optimasi dalam perancangan sistem kendali.

(CLO-01) Mastering the concepts and principles of intelligent control systems, i.e fuzzy control and neural network for analysis and design of nonlinear systems, and genetic algorithm for optimization purposes in control system design.

(CPMK-02) Mampu mendesain sistem cerdas untuk sistem nyata dengan bantuan Matlab/Simulink.

(CLO-02) Able to design intelligent control systems for real systems with the help of Matlab / Simulink.

(CPMK-03) Mampu menunjukkan kinerja mandiri, bermutu, dan terukur melalui tugas desain sistem pengaturan cerdas dan mampu menggunakan software Matlab/ Simulink untuk melakukan simulasi sistem hasil desain.

(CLO-03) Able to work independently showing quality and measurable performance through intelligent control system design tasks and able to use Matlab / Simulink software to perform system simulation design results

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri dan dapat bekerja sama dalam tim untuk memeroleh hasil rancangan sistem yang baik.
(CLO-04) Demonstrate an attitude of responsibility for work in his area of expertise independently and can work together in teams to obtain good system design results.

Topik/Pokok Bahasan
Main Subjects

1. Pengenalan Konsep Sistem Cerdas
   Introduction to Intelligent Control System Concepts
2. Logika Fuzzy dan Sistem Fuzzy
   Fuzzy Logic and Fuzzy Systems
3. Model Fuzzy Takagi-Sugeno
   Takagi-Sugeno Fuzzy Model
4. Aplikasi Pengaturan Fuzzy pada Sistem Pendulum-Kereta
   Fuzzy Control Application on the Pendulum-Cart System
5. Sintesa Pengaturan Fuzzy dengan Teknik Pengaturan Lainnya
   Synthesis of Fuzzy Control with Other Control Techniques
6. Neural Network dan Aplikasinya dalam Pengaturan
   Neural Network and Its Application in Control
7. Optimisasi menggunakan Teknik Genetic Algorithm
   Optimization using the Genetic Algorithm Technique

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
8. *Final examination*

Pustaka
Reference(s)

[1] Kevin M. Passino and Stephen Yurkovich, “Fuzzy Control,” Addison-Wesley Longman Inc., 1998.
[2] Kazuo Tanaka, Hua O. Wang, “Fuzzy Control Systems Design and Analysis: A Linear Matrix Inequality Approach,” John Wiley & Sons, 2001
[3] Stuart J. Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach,” 3rd Edition., Pearson Education, Inc., 2010
[4] Melanie Mitchell., An Introduction to Genetic Algorithms., the MIT press, 1996
[5] Stephen I. Gallant, “Neural Network Learning and Expert Systems,” the MIT press, London,1993

Prasyarat
Prerequisite(s)

EE184404 Dasar Sistem Pengaturan
EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Pengolahan Sinyal Pengaturan *Signal Processing for Control*
	Kode MK *Code*	:	EE184923
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Prof.Ir. Abdullah Alkaff, M.Sc, Ph.D
	Pengajar *Lecturer*	:	Prof.Ir. Abdullah Alkaff, M.Sc, Ph.D
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah pengolahan sinyal pengaturan membahas metode pengolahan sinyal yang terkontaminasi gangguan untuk mendapatkan model, atau identifikasi, dari sistem yang membangkitkan sinyal tersebut. Model yang digunakan adalah model sistem linier waktu diskrit dan digunakan melakukan estimasi dan prediksi state sistem berdasarkan model yang diidentifikasi. Model-model sistem yang dibahas antara lain model ARMA, ARMAX, dan ARIMA yang selanjutnya digunakan untuk estimasi dan prediksi state menggunakan filter Wiener dan filter Kalman.

This course discusses methods of processing signals that are contaminated by interference and noise to obtain mathematical models (also called system identification), and systems that generates such signals. The models are discrete-time linear models and they are used to estimate and predict the states of the systems based on the identified models. The system models are limited to ARMA, ARMAX and ARIMA which are then used for estimation and prediction of states using Wiener filter and Kalman filter.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah
Course Learning Outcomes

(CPMK-01) Menguasai konsep estimasi permodelan menggunakan data pengukuran serta konsep estimasi state untuk sistem liner.
(CLO-01) Mastering the concept of modeling estimation using measurement data and the concept of state estimation for linear system.

(CPMK-02) Mampu memodelkan sistem dinamik berbasis data pengukuran serta menggunakan model tersebut unuk melakukan estimasi state sistem.
(CLO-02) Capable of modeling dynamic system based on measurement data and using the model to make estimation of system state.

(CPMK-03) Mampu merealisasikan proses identifikasi dan estimasi state ke dalam bentuk kode komputer.
(CLO-03) Able to realize the process of identifying and estimating the state into the form of computer code.

Topik/Pokok Bahasan
Main Subjects

1. Identifikasi sistem
   System identification
2. Filter Wiener Digital
   Discrete-time Wiener filter
3. Filter Kalman
   Discrete-time Kalman filter

4. Aplikasi filter Winener dan filter Kalman
   Winener and Kalman filters applications

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

5.

Pustaka
Reference(s)

[1] Alkaff, A. Diktat Kuliah Teknik Penyaringan Optimal
[2] Candi, J.A., Model Based Signal Processing, Wiley-IEEE, 2006
[3] Brown, R.G. dan Y.C. Hwang, Introduction to Random Signals and Applied Kalman Filtering, 4th ed, Wiley, 2012
[4] Shanmugan, K.S. dan A. M. Breiphol, Random Signals: Estimation, Detection, and Data Analysis, Wiley, 1988

Prasyarat
Prerequisite(s)

EE184305 Sinyal dan Sistem
EE184305 Signals and Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Analisis Jaringan *Network Analysis*
	Kode MK *Code*	:	EE184924
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Prof.Ir. Abdullah Alkaff, M.Sc, Ph.D
	Pengajar *Lecturer*	:	Prof.Ir. Abdullah Alkaff, M.Sc, Ph.D
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Pengertian jaringan; teori graph; representasi graph dan jaringan; prosedur pemberian label; permasalahan lintasan terpendek; variasi dan aplikasi lintasan terpendek; algoritma lintasan terpendek; permasalahan spanning tree; variasi, aplikasi dan algoritma spanning tree; permasalahan aliran maksimum; variasi, aplikasi dan algoritma aliran maksimum; permasalahan transportasi dan transhipment; variasi, aplikasi dan algoritma transportasi dan transhipment; permasalahan biaya minimum; variasi, aplikasi dan algoritma biaya minimum; generalisasi aliran pada jaringan dan contoh-contoh aplikasinya; metode penyelesaian untuk salah satu contoh generalisasi aliran; jaringan Bayesian: variasi dan aplikasinya; serta jaringan sosial: variasi dan aplikasinya.

Understanding the network; graph theory; graph and network representation; labeling procedures; the shortest path problem; variations and the shortest path application; the shortest path algorithm; spanning tree problems; variations, applications and spanning tree algorithms; maximum flow problems; variations, applications and maximum flow algorithms; transportation and transhipment issues; variations, applications and transportation and transhipment algorithms; minimum cost issues; variations, applications and minimum cost algorithms; generalizing the flow on the network and examples of its application; method of completion for one example of flow generalization; Bayesian network: its variations and its applications; as well as social networks: variations and their applications

CPL Prodi yang Dibebankan

Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep Optimasi Jaringan dan Aplikasinya
(CLO-01) Mastering the concept of Network Optimization and its Application

(CPMK-02) Mampu menyelesaikan problema optimasi menggunakan metode-metode optimasi jaringan.
(CLO-02) Able to solve optimization problems using network optimization methods.

(CPMK-03) Mampu menggunakan bahasa pemrograman C/Java untuk mengimplementasi algoritma pemodelan dan penyelesaian permasalahan jaringan.
(CLO-03) Able to use C / Java programming language to implement algorithm modeling and solving network problems.

(CPMK-04) Berkontribusi dalam peningkatan mutu kehidupan bermasyarakat, berbangsa, bernegara, dan peradaban berdasarkan Pancasila.

(CLO-04) Contributing to improving the quality of life of society, nation, state, and civilization based on Pancasila.

Topik/Pokok Bahasan
Main Subjects

1. Teori Graph
   Graph Theory
2. Konsep & Representasi Jaringan
   Network Concepts & Representations
3. Lintasan Terpendek
   Shortest path
4. Spanning Tree
   Spanning Tree
5. Aliran Maksimum
   Maximum flow
6. Transportasi dan Transhipment
   Transportation and Transhipment
7. Biaya Minimum
   Minimum Cost
8. Generalisasi Aliran pada Jaringan
   Flow Generalization on the Network
9. Jaringan Bayesian
   Bayesian Network
10. Jaringan Sosial
    Social Networking

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

11.

Pustaka ***Reference(s)***
[1] Bertsektas, Dimitri P. Network Optimization: Continuous and Discrete Models. Athena Scientific, Massachusetts, 1998. [2] Philips, D.T. Fundamentals of Network Analysis. Prentice-Hall, New Jersey, 1980. [3] Jensen, P.A. dan J.W.Barnes. Network Flow Programming. John Wiley & Sons Inc., New York 1980. [4] Ahuja, Ravindra K., Thomas L Magnanti, James B Orlin. Network Flow Analysis. Prentice-Hall, 1993 [5] Alkaff, Abdullah. Diktat Analisa Jaringan. Diktat Kuliah, TSP, JTE, 2000.
Prasyarat ***Prerequisite(s)***
EE184201 Aljabar Linier dan Struktur Diskrit *EE184201 Linear Algebra and Discrete Structure*

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Multi Agen *Multi-agent Systems*
	Kode MK *Code*	:	EE184925
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Mochammad Sahal, S.T.,M.Sc.
	Pengajar *Lecturer*	:	Mochammad Sahal, S.T.,M.Sc.
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Sistem Multi Agen membahas tentang konsep sistem multi agen: pengaturan dan aplikasinya, Protokol kesepakatan statis antar agen, Protokol kesepakatan dinamis antar agen, Kesepakatan antar agen dalam gangguan acak, Pengaturan formasi antar agen, Pengaturan kooperatif antar agen, Estimasi berdasarkan informasi berasal dari multi agen, Konflik antar agen.

The multi-agent systems course discusses the concepts of multi-agent systems: control and applications, static agreement protocols between agents, dynamic agreement protocols, agreements in random noise, formation control, inter-agent cooperative control, information-based estimates derived from multi-agent, conflict between agents.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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 fakta, konsep, prosedur, dan prinsip sitem multi agen.
(CLO-01) Mastering the facts, concepts, procedures, and principles of multi-agent systems.

(CPMK-02) Mampu menganalisis protokol kesepakatan, pengaturan formasi, pengaturan kooperatif, estimasi informasi multi agen, konflik antar agen.
(CLO-02) Able to analyze protocol agreements, formation control, cooperative control, estimates of multi-agent information, conflicts among agents.

(CPMK-03) Mampu menggunakan software Matlab/Simulink untuk melakukan simulasi protokol kesepakatan, pengaturan formasi, pengaturan kooperatif, estimasi informasi multi agen, konflik antar agen.
(CLO-03) Able to use Matlab / Simulink software to simulate protocol agreement, formation control, cooperative control, estimation of multi agent information, conflict between agent.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-04) Demonstrating a responsible attitude towards the work in the field of expertise independently.
Working together to be able to take full advantage of their potential.

Topik/Pokok Bahasan
Main Subjects

1. Konsep sistem multi agen: pengaturan dan aplikasinya
   The concept of multi-agent system: control and application
2. Protokol kesepakatan statis antar agen
   Static agreement protocol between agents
3. Protokol kesepakatan dinamis antar agen
   Dynamic agreement protocol between agents

4. Kesepakatan antar agen dalam gangguan acak
   Agreement among agents in random noise
5. Pengaturan formasi antar agen
   Formation control between agents
6. Pengaturan kooperatif antar agen
   Cooperative control between agents
7. Estimasi berdasarkan informasi berasal dari multi agen
   Estimates based on information come from multi agents
8. Konflik antar agen
   Conflict between agents

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
9. - *Final examination*

Pustaka
Reference(s)

[1] Mehran Mesbahi, Magnus Egerstedt, “Graph Theoritic Methods in Multiagent Networks,” 1st Edition, Princeton, New Jersey, 2010

Prasyarat
Prerequisite(s)

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Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Pengaturan Proses *Process Control Systems*
	Kode MK *Code*	:	EE184926
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Eka Iskandar, ST, MT
	Pengajar *Lecturer*	:	Eka Iskandar, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah sistem pengaturan proses memberi pengenalan mengenai sistem proses dan pengaturannya kepada mahasiswa teknik elektro. Pada mata kuliah ini disampaikan permodelan sistem proses untuk proses-proses yang umum digunakan di industri. Metode-metode analisis model tersebut dijelaskan untuk menampilan perilaku sistem. Pada bagian akhir dijelaskan metode-metode desain kontroler, diantaranya adalah kontroler PID yang banyak digunakan di industri.
Process Control System course gives an introduction to process system and their arrangement to the students of electrical engineering. In this course, modeling of commonly found processes in industries are presented, including the analysis methods of the system behavior. The final part describes the controller design methods, among which are PID controllers that are widely used in industry.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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 dan teori analisis dan desain sistem pengaturan proses.
(CLO-01) Mastering the concepts and theories of analysis and design of process control system

(CPMK-02) Mampu memodelkan, menganalisis, dan mendesain sistem pengaturan proses.
(CLO-02) Able to model, analyze, and design process control systems

(CPMK-03) Mampu merealisasi sistem pengaturan untuk sistem proses dengan perangkat lunak.
(CLO-03) Able to realize control system for process system using softwares

(CPMK-04) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-04) Working in team to maximize possible possessed potential.

Topik/Pokok Bahasan
Main Subjects

1. Introduksi sistem pengaturan proses
   Introduction to Process Control System
2. Model matematika proses
   Mathematical process model
3. Kontroler berbasis model
   Model based controller
4. Kontrol loop
   Control loop
5. Desain konseptual sistem pengaturan proses
   Conceptual design of Process Control System
6. Desain simulasi sistem pengaturan proses
   Design the simulation of Process Control System
7. Desain implementasi sistem pengaturan proses
   Design the implementation of Process Control System

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
8. - *Final examination*

Pustaka
Reference(s)

[1] Babatunde A. Ogunnaike, Process, Dynamics, Modeling and Control, 1994.
[2] Wolfgang Altmann, "Practical Process Control for Engineers and Technicians," John Elsevier, 2005
[3] W.L. Luyben, "Process Modeling, Simulation and Control for Chemical Engineers," McGraw Hill, 2nd edition, 1990.

Prasyarat
Prerequisite(s)

EE184404 Dasar Sistem Pengaturan
EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Pengaturan Penggerak Elektrik *Control of Electric Drives*
	Kode MK *Code*	:	EE184927
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Dimas Anton Asfani, ST, MT.
	Pengajar *Lecturer*	:	Dr. Dimas Anton Asfani, ST, MT.
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah ini membahas metode kendali terkini di sistem pengendali elektrik, power transfer circuit (PWM Inverter 3 fasa), servo motor DC brushless, pengendali kecepatan dan posisi, speed sensorless control, dan membuat perangkat lunak pada system penggerak elektrik.
This course discusses the latest control system analysis and design methods in electrical control systems, power transfer circuits (PWM Inverter 3 phase), brushless DC motor servo, speed and position controller, speed sensorless control, and makes software on electric drive system

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah
Course Learning Outcomes

(CPMK-01) Mampu menjelaskan dinamika sistem motor berbeban, cara kerja motor dc, motor induksi, metode pengaturan tegangan AC motor induksi, prinsip kerja motor sinkron.
(CLO-01) Mastering the concept of the dynamics of loaded motor system, how dc motor works, induction motor, voltage control method for AC induction motor, synchronous motor work principle

(CPMK-02) Mampu meracang rectifier control, chopper control, pengaturan loop tertutup untuk dc drives, speed control dan multiquadrant control, pengaturan menggunakan inverter sumber tegangan, pengaturan menggunakan inverter sumber arus, self control untuk motor sinkron.
(CLO-02) Able to dispose of rectifier control, chopper control, closed-loop control for dc drives, speed control and multi quadrant control, control using voltage source inverter, control using current source inverter, self control for synchronous motor.

(CPMK-03) Mampu merancang rectifier control, chopper control, pengaturan loop tertutup untuk dc drives, speed control dan multiquadrant control, pengaturan menggunakan inverter sumber tegangan, pengaturan menggunakan inverter sumber arus, self control untuk motor sinkron menggunakan MATLAB, mikrokontroller.
(CLO-03) Capable of designing rectifier control, chopper control, closed loop control for dc drives, speed control and multi quadrant control, control using voltage source inverter, control using current source inverter, self control for synchronous motor using MATLAB, microcontroller.

Topik/Pokok Bahasan
Main Subjects

1. Dinamika Motor DC
   DC Motor Dynamics
2. Pengaturan Motor DC
   Control of DC Motor

3. Dinamika Motor Induksi
   Induction Motor Dynamics
4. Pengaturan Motor Induksi
   Control of Induction Motor
5. Pengaturan Motor Sinkron
   Control of Synchronous Motor

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

6.

Pustaka
Reference(s)

[1] DUBEY, Gopal K : Power Semiconductor Controlled Drives, Prentice Hall, Inc., 1989
[2] Subrahmanyam, Vedam : Electric Drives Concepts & Applications, McGraw-Hill, 1996

Prasyarat
Prerequisite(s)

EE184521 Desain dan Analisis Sistem Pengaturan
EE184521 Control System Analysis and Design

Mata Kuliah ***Course***	Nama MK *Name*	:	Robotika *Robotics*
	Kode MK *Code*	:	EE184928
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Prof.Dr.Ir. Achmad Jazidie, M.Eng
	Pengajar *Lecturer*	:	Prof.Dr.Ir. Achmad Jazidie, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah ini membahas konsep penerapan robotika di bidang otomasi industri, dan penerapan metode kendali terkini pada robotika di bidang otomasi industri.
This course discusses the concept of robotics application in the field of industrial automation, and the application of methods in analysis and design of control systems to robotics are presented as well.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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

Capaian Pembelajaran Mata Kuliah
Course Learning Outcomes

(CPMK-01) Mampu melakukan analisis kinematika dan dinamika robot.
(CLO-01) Mastering the concept of kinematics and dynamics of a robot manipulator.

(CPMK-02) Mampu memformulasikan permasalahan kendali robot berdasarkan model kinematika dan dinamika robot.
(CLO-02) Able to analyze kinematics and dynamics of a given robot manipulators.

(CPMK-03) Mampu mengimplementasikan analisis kontrol dan desain manipulator robot dengan menggunakan software.
(CLO-03) Able to implement the control analysis and design of a robot manipulator by using software.

Topik/Pokok Bahasan
Main Subjects

1. Transformasi Koordinat
   Coordinate Transformation
2. Kinematika Robot
   Kinematics Robot
3. Differential Motion
   Differential Motion
4. Dinamika Robot
   Robot Dynamics
5. Robotic Control
   Robotic Control

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

6.- *Final examination*
Pustaka ***Reference(s)***
[1] Mark W Spong, M Vibyasagar, "Robot Dynamics and Control", John Wiley & Sons, 1989 [2] H Asada, JJE Slotine, "Robot Analysis and Control", John Wiley & Sons, 1986
Prasyarat ***Prerequisite(s)***
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Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Pengaturan Embedded *Embedded Control Systems*
	Kode MK *Code*	:	EE184929
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	M. Abdul Hady, ST, MT
	Pengajar *Lecturer*	:	M. Abdul Hady, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah ***Description of Course***
Mata kuliah sistem pengaturan embedded merupakan mata kuiah yang memberikan pengenalan pada sistem pengaturan dengan menggunakan mikrokontroler atau system-on-chip. Setelah menjelaskan konsep dan arsitektur sistem embedded, metode permodelan dari sistem embedded diberikan. Metode analisis berdasarkan model yang diberikan yang selanjutnya dapat didisain sistem embedded yang operasional. Metode pemrograman dan aplikasi praktis menjadi bagian integral dari mata kuliah ini. *Embedded system course provides an introduction to control systems implemented on a microcontroller or system-on-chip. After explaining the concept and architecture of the embedded system, methods to model the embedded system are presented. Analytical methods based on the obtained model can then be designed on an embedded systems. Programming and practical applications become an integral part of this course.*
CPL Prodi yang Dibebankan ***Learning Outcomes***
(CPL-01) Mampu menerapkan ilmu pengetahuan alam dan matematika pada bidang teknik elektro *(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem* (CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro *(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering* (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 dan teori sistem embedded untuk aplikasi sistem pengaturan.
(CLO-01) Master the concepts and theory of embedded systems for control system applications.

(CPMK-02) Mampu melakukan analisis dan desain sistem pengaturan berbasis mikro kontroler.
(CLO-02) Able to perform analysis and design of microcontroller based control system.

(CPMK-03) Mampu melakukan implementasi sistem embedded untuk sistem pengaturan menggunakan mikro kontroler.
(CLO-03) Able to perform embedded system implementation for control system using microcontroller.

(CPMK-04) Berusaha secara maksimal untuk mencapai hasil yang sempurna.
(CLO-04) Trying to the fullest to achieve perfect results.

Topik/Pokok Bahasan
Main Subjects

1. Pengenalan sistem embedded & Sistem Real Time
   Introduction to embedded systems and real-time systems
2. Perancangan Sistem
   Embedded system models
3. Model Sistem Embedded
   Embedded system design
4. Teknik pemrograman bahasa C untuk sistem embedded
   C programming for embedded systems
5. Teknik Pengembangan Sistem Embedded
   Embedded system development approaches
6. Penjadwal

Scheduler

7. RTOS (Real Time Operating System)
   RTOS (Real Time Operating System)
8. Pengenalan Prosesor ARM 32 bit
   Introduction to 32-bit ARM processor

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*

9.

Pustaka
Reference(s)

[1] David E. Simon, “An Embedded Software Primer”, Addison-Wesley, 1999
[2] Jean J. Labrosse, “MicroC/OS-II The Real-Time Kernel”, R&D Books, Lawrence, 1999
[3] Berger, Arnold, "Embedded Systems Design: An Introduction to Processes, Tools, and Techniques", CMP Books, Lawrence Kansas

Prasyarat
Prerequisite(s)

EE184404 Dasar Sistem Pengaturan
EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Sekuriti dan Kriptografi *Security and Cryptography*
	Kode MK *Code*	:	EE184930
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr.Ir. Wirawan, DEA
	Pengajar *Lecturer*	:	Dr.Ir. Wirawan, DEA
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Dengan semakin pesatnya perkembangan jaringan komunikasi dan internet dan semakin luasnya penggunaan perangkat serta data yang terhubung ke jaringan, tantangan terhadap keamanan informasi dan jaringan semakin penting. Pada mata kuliah ini mahasiswa akan mempelajari permasalahan keamanan pada data, sistem komunikasi dan jaringan, serta teknik-teknik yang digunakan untuk mengatasinya. Secara khusus akan dibahas teori bilangan dan finite field yang diperlukan untuk memahami teknik-teknik kriptografi, baik simetrik dan asimetrik, serta algoritma-algoritma untuk melindungi integritas data. Mahasiswa juga akan mempelajari aplikasi kriptografi pada keamanan content multimedia.

With the rapid development of communication and internet networks and the increasingly widespread use of devices and data connected to the network, the challenges to information security and networking are increasingly important. In this course students will study security issues in data, communication systems and networks, and the techniques used to overcome them. Specifically, number theory and finite fields will be discussed to understand cryptographic techniques, both symmetric and asymmetric, and algorithms to protect data integrity. Students will also study cryptographic applications on the security of multimedia content.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-06) Mampu mematuhi hukum dan perataruran yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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 tantangan dan konsep keamanan pada sistem komunikasi dan jaringan untuk distribusi data, serta teknik-teknik berbasis kriptografi untuk mengatasi permasalahan keamanan dan melindungi integritas data.
(CLO-01) Mastering the challenges and concepts of security in communication and network systems for data distribution, as well as cryptographic-based techniques to overcome security issues and protect data integrity.

(CPMK-02) Mampu menjelaskan prinsip kerja dari teknik-teknik kriptografi simetrik dan asimetrik serta penerapannya untuk mengatasi permasalahan keamanan pada sistem komunikasi dan jaringan.
(CLO-02) Able to explain the working principles of symmetric and asymmetric cryptographic techniques and their application to overcome security problems in communication and network systems.

(CPMK-03) Mampu menggunakan perangkat lunak dan tool untuk mengimplementasikan teknik-teknik kriptografi dan simulasi sistem keamanan di jaringan, misal Matlab dan ns-3.
(CLO-03) Able to use software and tools to implement cryptographic techniques and system security simulations on the network, such as Matlab and ns-3.

(CPMK-04) Mampu menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-04) Able to show an attitude of responsibility for work in his area of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Pengantar tentang konsep keamanan pada sistem komunikasi dan jaringan
   Introduction to the concept of security in communication and network systems
2. Dasar-dasar teori bilangan
   Basics of number theory
3. Teknik-teknik enkripsi klasik
   Classic encryption techniques
4. Block Cipher dan Data Encryption Standard (DES)
   Block Cipher and Data Encryption Standard (DES)
5. Dasar-dasar finite field
   Finite field basics
6. Advanced Encryption Standard (AES)
   Advanced Encryption Standard (AES)
7. Kriptografi kunci publik dan RSA
   Public key cryptography and RSA
8. Fungsi Hash dan otentifikasi pengguna
   Hash function and user authentication
9. Kontrol akses jaringan dan keamanan cloud
   Network access control and cloud security
10. Keamanan jaringan nirkabel
    Wireless network security
11. Keamanan untuk multimedia content
    Security for multimedia content

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] William Stallings, “Cryptography and Network Security: Principles and Practice,” 7th ed., Pearson, 2017.
[2] Jonathan Katz & Yehuda Lindell, “Introduction to Modern Cryptography,” 2nd ed., CRC Press, 2015.

Prasyarat
Prerequisite(s)

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Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Gelombang Mikro, Radar dan Navigasi *Microwave, Radar and Navigation Systems*
	Kode MK *Code*	:	EE184931
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Prasetiyono Hari Mukti, ST, M.Sc
	Pengajar *Lecturer*	:	Dr. Prasetiyono Hari Mukti, ST, M.Sc
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	A student must have attended at least 75% of the lectures to sit in the exams

Deskripsi Mata Kuliah
Description of Course

Sistem Gelombang Mikro, Radar dan Navigasi merupakan mata kuliah pilihan yang memiliki capaian pembelajaran memahami konsep sistem gelombang mikro dan mengetahui komponen-komponen sistem gelombang mikro, mamahami prinsip kerja sistem-sistem gelombang mikro, memahami konsep radar, mengetahui jenis-jenis radar dan memahami prinsip kerjanya, Network analysis, Noise dan distorsi, pengetahuan tentang navigasi tentang LORAN C, dan navigasi berbasis satelit.

Microwave Systems, Radar and Navigation are elective courses that have learning achievements to understand the concept of microwave systems and know the components of a microwave system, understand the working principles of microwave systems, understand the concept of radar, know the types of radars and understand the principles it works, Network analysis, Noise and distortion, knowledge of navigation about LORAN C, and satellite-based navigation.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by

considering safety, social, cultural, environmental and economic aspects

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep sistem gelombang mikro dan mengetahui komponen-komponen sistem gelombang mikro.
(CLO-01) Mastering the concept of microwave systems and knowing the components of a microwave system.

(CPMK-02) Menguasai prinsip kerja sistem-sistem gelombang mikro.
(CLO-02) Mastering the working principles of microwave systems.

(CPMK-03) Menguasai konsep radar, mengetahui jenis-jenis radar dan memahami prinsip kerjanya.
(CLO-03) Mastering the concept of radar, knowing the types of radars and understanding their working principles.

(CPMK-04) Mampu mendesain sistem gelombang mikro dan aplikasi sistem radar
(CLO-04) Able to design microwave systems and radar system applications.

(CPMK-05) Mampu menggunakan pengetahuan tentang gelombang mikro khususnya radar untuk implementasi dalam kehidupan sehari-hari.
(CLO-05) Able to use knowledge about microwaves, especially radar for implementation in everyday life.

(CPMK-06) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-06) Demonstrate an attitude of responsibility for work in his area of expertise independently.

(CPMK-07) Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-07) Working together to be able to make the most of their potential.

Topik/Pokok Bahasan
Main Subjects

1. Radar
   Radar
2. Network analysis
   Network analysis
3. Komponen gelombang mikro
   Microwave component
4. Noise dan distorsi
   Noise and distortion
5. LORAN C
   LORAN C
6. Navigasi berbasis Satelit
   Satellite based navigation

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] David M. Pozar, “Microwave and RF wireless Systems”, John Wiley & Sons, 2001. [2] Richards, “Principles of Modern Radar part 1: basic principles”, Spitich, 2010 [3] Skolnik, “Introduction to radar systems”, edisi-3, Mc Graw Hill, 2001 [4] R. Garg & Bahl, Microstrip Lines & Slotlines, Artech, 1979. [5] Laurie Tetley, David Calcutt, “Electronic Navigation Systems, ed. 3, Routledge, 2001
Prasyarat ***Prerequisite(s)***
EE184633 Elektronika Komunikasi *EE184633 Communication Electronics* EE184532 Transmisi Gelombang Elektromagnetik dan Antena *EE184532 Electromagnetic Wave Transmission and Antennas*

Mata Kuliah ***Course***	Nama MK *Name*	:	Standard dan Keandalan Telekomunikasi *Standards and Reliability in Telecommunication*
	Kode MK *Code*	:	EE184932
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Sri Rahayu, ST, M.Kom
	Pengajar *Lecturer*	:	Sri Rahayu, ST, M.Kom
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian

	A student must have attended at least 75% of the lectures to sit in the exams

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Standard dan Keandalan membahas tentang standar dan Regulasi Telekomunikasi secara umum, UU-Telekomunikasi khususnya tentang penyelenggaraan telekomunimasi (jaringan, layanan & telsus), UU-ITE khususnya penyelenggaraan transaksi elektronik serta kriteria baku dan ketentuan yang berlaku untuk Sistem dan Layanan Telekomunikasi. Mata Kuliah Standard dan Keandalan juga mempelajari standard dan regulasi di bidang Komunikasi Data, Jaringan, Komunikasi Multimedia dan Pengolahan Sinyal. Standard dan regulasi di bidang Transmisi/Propagasi, Manajemen Frekuensi dan Alokasi Spektrum juga dikaji dalam mata kuliah ini, selain tentang Security & Safety, Konsep Keandalan, Parameter Keandalan dan contoh penerapannya dalam Perancangan Sistem Telekomunikasi.

The Standard and Reliability course discusses general Telecommunication standards and Regulations, the Telecommunications Law specifically concerning the implementation of telecommunication (network, service & telephone), UU-ITE specifically the implementation of electronic transactions as well as the standard criteria and provisions applicable to Telecommunications Systems and Services. Standard and Reliability courses also study standards and regulations in the fields of Data Communication, Networking, Multimedia Communication and Signal Processing. Standards and regulations in the field of Transmission / Propagation, Frequency Management and Allocation of Spectrum are also examined in this course, in addition to Security & Safety, Concepts of Reliability, Reliability Parameters and examples of their application in Telecommunication System Design.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep kinerja Sistem Telekomunikasi dan standar kualitas Layanan Telekomunisi secara umum.

(CLO-01) Mastering the concepts of Telecommunications System performance and quality standards for Telecommunication Services in general.

(CPMK-02) Mampu menemukan permasalahan yang berpotensi mengganggu proses bertelekomunikasi

(CLO-02) Able to find and solve the problems that have the potential to disrupt the telecommunications process.

(CPMK-03) Mampu mengakomodasi parameter-parameter kinerja Sistem Telekomunikasi yang mempengaruhi kualitas Layanan Telekomunikasi.
(CLO-03) Able to accommodate the performance parameters of a Telecommunication System that affect the quality of Telecommunications Services.

(CPMK-04) Mampu mengevaluasi data hasil pengukuran Sistem Telekomunikasi dikaitkan kriteria kualitas standar dan ketentuan regulasi yang berlaku.
(CLO-04) Able to evaluate the results of the Telecommunications System measurement data is related to the quality criteria of standards and applicable regulatory provisions.

(CPMK-05) Menunjukkan sikap bertanggungjawab (professional), disiplin pada aturan (standar) dan taat pada hukum (regulasi) terkait bidang pekerjannya.
(CLO-05) Demonstrate responsibility (professional), discipline in rules (standards) and obey the law (regulation) related to the field of work.

Topik/Pokok Bahasan
Main Subjects

1. Standar dan regulasi Telekomunikasi
   Telecommunications standards and regulations
2. UU-Telekomunikasi & UU-ITE
   UU-Telekomunikasi & UU-ITE
3. Standarisasi Sistem dan Layanan Telekomunikasi
   Standardization of Telecommunications Systems and Services
4. Standar dan regulasi untuk Komunikasi Data dan Jaringan
   Standards and regulations for Data Communication and Networks
5. Standar dan regulasi untuk Komunikasi Multimedia dan Pengolahan Sinyal
   Standards and regulations for Multimedia Communication and Signal Processing

6. Standar dan regulasi untuk bidang Transmisi/Propagasi, Manajemen Frekuensi dan Alokasi Spektrum
   Standards and regulations for the field of Transmission / Propagation, Frequency Management and Spectrum Allocation
7. Standar dan regulasi untuk Security & Safety
   Standards and regulations for Security & Safety
8. Konsep keandalan Sistem Telekomunikasi.
   The concept of reliability of the Telecommunication System.
9. Parameter keandalan Sistem Telekomunikasi
   Reliability parameters of the Telecommunications System
10. Analisis keandalan dalam Perancangan Sistem Telekomunikasi.
    Reliability analysis in Telecommunication System Design.

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] ITU Recommendation (ITU-T, ITU-R)
[2] UU Telekomunikasi, UU ITE, UU Penyiaran dll.
[3] Peraturan Menteri Kominfo dan turunannya
[4] Martin L. Shooman, Reliability of Computer Systems and Networks, John Willey & Sons, 2002
[5] Greg Utas, Robust Communications Software, John Willey & Sons, 2005
[6] Mark L. Ayers, Telecommunications System Reliability Engineering, Theory and Practices, IEEE,2012

[7] Lazzaroni, Massimo, Reliability Engineering Basic Concepts and Applications in ICT,2011

Prasyarat
Prerequisite(s)

EE184302 Dasar Sistem dan Jaringan Telekomunikasi
EE184302 Introduction to Telecommunication Systems and Networks

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Broadcast *Broadcast System*
	Kode MK *Code*	:	EE184933
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ir. Endroyono, DEA
	Pengajar *Lecturer*	:	Dr. Ir. Endroyono, DEA Ir.Gatot Kusrahardjo, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata-kuliah sistem broadcasting memberikan dasar sistem penyiaran yang merupakan bagian dari bidang Teknik Telekomunikasi Multimedia. Mata Kuliah ini mempelajari tentang standard dan regulasi bidang penyiaran analog dan digital, model bisnis penyiaran, hingga dasar perancangan sistem penyiaran analog dan digital, termasuk teknologi hingga optimasi parameter teknik penyiaran digital dan pengukuran kinerjanya dikaitkan dengan kondisi kanal, serta jumlah dan kualitas transmisi yang diinginkan.

Broadcasting system course provides the basic of a broadcasting system that is part of the Multimedia Telecommunications Engineering field. This course learns about standards and regulations in the field of analog and digital broadcasting, broadcasting business models, to the basis of designing analog and digital broadcasting systems, including technology to optimize digital broadcasting technical parameters and measuring performance associated with channel conditions, as well as the desired transmission quantity and quality.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep, prinsip, dan prosedur perancangan sistem broadcasting, yang melibatkan 3 aspek utama, yaitu aspek regulasi, aspek model bisnis penyelenggaraan penyiaran, dan aspek teknologi penyiaran analog dan digital.
(CLO-01) Mastering the concepts, principles, and procedures for broadcasting system design, which involves 3 main aspects, namely regulatory aspects, aspects of the business model of broadcasting, and analog and digital broadcasting technology aspects.

(CPMK-02) Mampu memformulasikan rekayasa melalui rancangan survey dan disain link budget serta pemilihan parameter penyiaran analog dan digital dalam rangka memperoleh sistem penyiaran dengan cakupan layanan dan kualitas yang memadai sesuai standard dan regulasi yang berlaku di bidang penyiaran , termasuk alternatif penyelesaian permasalahan yang lain.
(CLO-02) Able to formulate engineering through survey design and link budget design and selection of analog and digital broadcasting parameters in order to obtain a broadcasting system with adequate service and quality coverage in accordance with applicable standards and regulations in the broadcasting sector, including alternative solutions to other problems.

(CPMK-03) Mempunyai kemampuan perancangan sistem penyiaran analog dan digital dengan memperhatikan aspek pemancaran; media transmisi (terestrial, satelit dan melalui kabel); dan penerimaan sinyal, berdasarkan hasil analisis informasi dan data.
(CLO-03) Having the ability to design analog and digital broadcasting systems by taking into account the transmission aspects; transmission

media (terrestrial, satellite and via cable); and signal reception, based on the results of analysis of information and data.

(CPMK-04) Menunjukkan hasil belajar untuk taat hukum melalui pembelajaran regulasi dan bekerja sama untuk memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-04) Demonstrate the results of learning to obey the law through regulatory learning and work together to make the most of their potential.

Topik/Pokok Bahasan
Main Subjects

1. Definisi dan pengantar sistem penyiaran
   Definition and introduction to broadcasting systems
2. UU Telekomunikasi dan UU Penyiaran
   Telecommunications Law and Broadcasting Law
3. Keputusan Menteri (KM) tentang Penyiaran (Masterplan dll.)
   Ministerial Decree (KM) concerning Broadcasting (Masterplan etc.)
4. Rancangan Sistem Penyiaran Analog dan Digital: Regulasi, Model Bisnis dan Teknologi
   Design of Analog and Digital Broadcasting Systems: Regulations, Business Models and Technology
5. Desain link budget dalam sistem radio berdasar KM
   Design a link budget in a radio system based on KM
6. Disain link budget dalam sistem televisi analog berdasar KM
   Link budget design in analog television systems based on KM
7. Standard Penyiaran Digital
   Digital Broadcasting Standard
8. Teknik audio dan video digital, Teknik Pengkodean Sumber
   Digital audio and video techniques, Source Encoding Techniques
9. Teknik Pengkodean Kanal (Koreksi Kesalahan)
   Channel Code Technique (Error Correction)
10. Teknik Modulasi Digital di Penyiaran, termasuk teknik COFDM
    Digital Modulation Techniques in Broadcasting, including COFDM techniques
11. Digital Video Broadcasting (DVB-T, DVB-T2, DVT-T2 Lite)

Digital Video Broadcasting (DVB-T, DVB-T2, DVT-T2 Lite)

12. Dasar optimasi parameter transmisi penyiaran digital
    Basic optimization of parameters of digital broadcast transmission
13. Teknik Alokasi Frekuensi: MFN-SFN
    Frequency allocation technique: MFN-SFN
14. Pengukuran kinerja Penyiaran Digital
    Digital Broadcast performance measurement

Pustaka
Reference(s)

[1] UU Telekomunikasi
[2] UU Penyiaran
[3] KM. 15/2003, KM 76/2003 dan Penggantinya
[4] ETSI EN.744
[5] K. Blair B & Jerry W, "Television and Audio Handbook for technician and Engineer", McGraw-Hill, 1990
[6] Walter Fischer, Digital Video & Audio Broadcasting Technology: A Practical Engineering Guide, , 3rd Edition, Rohde-Schwarz, Springer-Verlag, 2010
[7] Endroyono, dkk., "Modul Ajar Kuliah Broadcasting", 2014

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*

Prasyarat
Prerequisite(s)

- EE184631 Sistem Komunikasi II
  EE184631 Communication Systems 2
- EE184632 Propagasi Gelombang

EE184632 Wave Propagation

- EE184633 Elektronika Komunikasi
  EE184633 Communication Electronics

Mata Kuliah ***Course***	Nama MK *Name*	:	Layanan Dalam Jaringan *Services over Networks*
	Kode MK *Code*	:	EE184934
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Eko Setijadi, ST, MT, PhD
	Pengajar *Lecturer*	:	Eko Setijadi, ST, MT, PhD
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Layanan Dalam Jaringan membahas penyediaan layanan berbasis jaringan, jenis dan karakteristik layanan, arsitektur sistem penyedia layanan berbasis internet, kualitas layanan dan rekayasa jaringan.

The Service over Network course discusses the provision of network-based services, types and characteristics of services, internet-based service provider architecture, service quality and network engineering.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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) Mengetahui perkembangan teknologi sistem dan jaringan komunikasi nirkabel, serta memahami perencanaan dan kinerja jaringan komunikasi nirkabel.

(CLO-01) Knowing the development of wireless communication system and network technology, and understanding the planning and performance of wireless communication networks.

(CPMK-02) Mampu menjelaskan penyediaan layanan dalam jaringan, termasuk jenis dan karakteristik layanan.
(CLO-02) Able to explain the provision of services in the network, including the types and characteristics of services.

(CPMK-03) Mampu menjelaskan arsitektur sistem penyedia layanan dalam internet
(CLO-03) Able to explain the system architecture of service providers on the internet

(CPMK-04) Mampu mengimplementasikan arsitektur infrastruktur penyedia layanan dalam skala kecil.
(CLO-04) Able to implement service provider infrastructure architecture on a small scale.

(CPMK-05) Mampu menjelaskan kualitas layanan dan rekayasa jaringan.
(CLO-05) Able to explain service quality and network engineering.

(CPMK-06) Mampu mengukur dan mengevaluasi kualitas layanan dalam jaringan internet.
(CLO-06) Able to measure and evaluate the quality of services in the internet network.

(CPMK-07) Mampu menjelaskan konsep layanan dalam jaringan internet dan kualitas layanan dalam jaringan internet.
(CLO-07) Able to explain the concept of service in the internet network and the quality of services in the internet network.

(CPMK-08) Mampu menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-08) Be able to show an attitude of responsibility for work in his area of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Penyediaan layanan berbasis jaringan, termasuk jenis dan karakteristik layanan.
   Provision of network-based services, including types and characteristics of services.
2. Arsitektur sistem penyedia layanan berbasis internet
   Internet-based service provider system architecture
3. Implementasi arsitektur infrastruktur penyedia layanan dalam skala kecil.
   Implementation of the infrastructure architecture of service providers on a small scale.
4. Kinerja dan kualitas layanan dalam jaringan.
   Service performance and quality in the network.
5. Pengukuran dan evaluasi kualitas layanan dalam jaringan internet.
   Measurement and evaluation of service quality in the internet network.

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] Oliver Heckman, the Competitive Internet Service Provider, John Willey & Sons, 2006

[2] Floris van den Broek, Management of Internasional Networks, CRC Press, 2000
[3] K. Sharon Evans, Telecommunications Network Modelling, Planning and Design, The Institution of Engineering and Technology, 2004
[4] Ramin Sadre, Scalability of Neworks and Services, Springer, 2009.
[5] Aileen Cater-Steel, Information Technology Governance and Service Management: Framework and Adaptations, Information Science Reference, 2009
[6] Tim Szigeti et al, End to End QoS Network Design, Cisco Press, 2014

Prasyarat
Prerequisite(s)

- EE184531 Sistem Komunikasi I
  EE184531 Communication Systems 1
- EE184533 Jaringan dan Rekayasa Trafik
  EE184533 Networks and Traffic Engineering

Mata Kuliah ***Course***	Nama MK *Name*	:	Rekayasa Sistem dan Manajemen Proyek Telekomunikasi *Telecommunication System Engineering and Project*
	Kode MK *Code*	:	EE184935
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Prof. Dr.Ir. Gamantyo Hendrantoro, M.Eng
	Pengajar *Lecturer*	:	Prof. Dr.Ir. Gamantyo Hendrantoro, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Rekayasa Sistem dan Manajemen Proyek Telekomunikasi membahas dua topik yang saling berhubungan. Pertama, mahasiswa belajar mengenai metode rekayasa sistem dan jaringan telekomunikasi dalam kaitan dengan permasalahan nyata, dengan bekal penguasaan ilmu yang telah diperoleh dari mata kuliah bidang telekomunikasi yang telah ditempuh sebelumnya. Setelah itu, mahasiswa belajar tentang metode perencanaan dan pengelolaan proyek di bidang telekomunikasi, dikaitkan dengan implementasi hasil rekayasa sistem dan jaringan telekomunikasi yang dipelajari dalam topik bahasan pertama.

The subject of System Engineering and Telecommunications Project Management addresses two interconnected topics. First, students learn about systems engineering methods and telecommunications networks in connection with real problems, with the mastery of the knowledge that has been gained from the courses in telecommunications that have been taken before. After that, students learn about the methods of planning and managing projects in the field of telecommunications, related to the implementation of the results of system engineering and telecommunications networks studied in the first topic of discussion.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-06) Mampu mematuhi hukum dan perataturan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(CPL-12) Mampu menunjukkan sikap religius, nasionalis, saling menghormati

(PLO-12) Capable to show religious, nationalist, and mutual respect characters

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep, prinsip, dan prosedur rekayasa dan optimasi sistem dan jaringan telekomunikasi.
(CLO-01) Mastering the concepts, principles and procedures of engineering and optimization of telecommunication systems and networks.

(CPMK-02) Menguasai konsep, prinsip, dan prosedur manajemen proyek di bidang telekomunikasi.
(CLO-02) Mastering project management concepts, principles and procedures in the telecommunications sector.

(CPMK-03) Mampu melakukan rekayasa dan optimasi terhadap sistem dan jaringan telekomunikasi dalam menyelesaikan permasalahan yang berkaitan dengan bidang telekomunikasi.
(CLO-03) Able to do engineering and optimization of telecommunication systems and networks in solving problems related to the telecommunications sector.

(CPMK-04) Mampu menerapkan manajemen proyek dalam melaksanakan proyek di bidang telekomunikasi.

(CLO-04) Able to apply project management in implementing projects in the telecommunications sector.

(CPMK-05) Mampu mengambil keputusan mengenai sistem dan jaringan telekomunikasi yang menjadi solusi optimal dalam penyelesaian permasalahan bidang telekomunikasi.
(CLO-05) Able to make decisions regarding telecommunication systems and networks which are the optimal solutions in solving telecommunication problems.

(CPMK-06) Mampu bekerja sama dan mengemban tanggung jawab bersama atas hasil pekerjaan kelompok dalam rekayasa dan optimasi telekomunikasi dan dalam manajemen proyek.
(CLO-06) Able to work together and carry out joint responsibility for the results of group work in telecommunications engineering and optimization and in project management.

(CPMK-07) Bekerja secara profesional dalam mencapai sistem dan jaringan telekomunikasi yang optimal dan dalam melaksanakan manajemen proyek.
(CLO-07) Work professionally in achieving optimal telecommunication systems and networks and in implementing project management.

(CPMK-08) Bekerja sama dalam kelompok untuk melakukan rekayasa dan optimasi sistem dan jaringan telekomunikasi dan melaksanakan manajemen proyek.
(CLO-08) Cooperate in groups to engineer and optimize telecommunications systems and networks and carry out project management.

Topik/Pokok Bahasan
Main Subjects

1. Teknologi Telekomunikasi sebagai Solusi
   Telecommunications Technology as a Solution
2. Metode Optimasi
   Optimization Method

3. Rekyasa dan Optimasi Sistem dan Jaringan Komunikasi
   Manipulation and Optimization of Communication Systems and Networks
4. Proyek dan Manajemen Proyek
   Project and Project Management
5. Work Breakdown Structure
   Work Breakdown Structure
6. Penjadwalan dan Cash Flow
   Scheduling and Cash Flow
7. Manajemen Risiko
   Risk Management
8. Organisasi Proyek
   Project Organization
9. Proposal Proyek
   Project Proposal

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

10. *Final examination*

Pustaka
Reference(s)

[1] Hamdy A. Taha, "Operations Research An Introduction", ed. 8, Prentice Hall, 2007.
[2] Bernard Sklar, "Digital Communications Fundamentals and Applications", ed. 2, Prentice Hall, 2001.
[3] Sharon Evans, "Telecommunications Network Modeling, Planning and Design", IEE, 2003

[4] Mostafa H. Sherif, "Managing Projects in Telecommunication Services", John Wiley and Sons, 2007.
[5] Celia L. Desmond, "Project Management for Telecommunications Managers", Kluwer Academic Publishers, 2004.

Prasyarat
Prerequisite(s)

- EE184531 Sistem Komunikasi I
  EE184531 Communication Systems I
- EE184532 Jaringan dan Rekayasa Trafik
  EE184532 Electromagnetic Wave Transmission and Antennas
- EE184533 Transmisi Gelombang Elektromagnetik dan Antena
  EE184533 Networks and Traffic Engineering

Mata Kuliah ***Course***	Nama MK *Name*	:	Rekayasa Internet dan Web *Internet Engineering and Web*
	Kode MK *Code*	:	EE184936
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr.Ir. Achmad Affandi, DEA
	Pengajar *Lecturer*	:	Dr.Ir. Achmad Affandi, DEA
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah ini memberikan pengenalan akan konsep dasar teknologi Internet dan web termasuk arsitektur, protokol dan aplikasi. Materi kuliah meliputi: Pengantar sejarah internet dan layanan Internet, dasar-dasar jaringan, protokol TCP / IP (pengalamatan, routing dan transport), pemrograman jaringan, pemrograman web, layanan web, server web dan keamanan Internet.

The course provides an introduction to the basic concepts of Internet and web technology including architecture, protocols and applications. Lecture material includes: Introduction to internet history and Internet services, network basics, TCP / IP protocols (addressing, routing and transport), network programming, web programming, web services, web servers and Internet security.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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 dasar dasar-dasar jaringan, protokol TCP / IP (pengalamatan, routing dan transport), pemrograman jaringan, pemrograman web, layanan web, server web dan keamanan Internet.
(CLO-01) Mastering the basic concepts of network basics, TCP / IP protocols (addressing, routing and transport), network programming, web programming, web services, web servers and Internet security.

(CPMK-02) Mampu menganalisis kualitas layanan dalam jaringan internet dan melakukan trouble shooting jika terjadi permasalahan dalam jaringan.
(CLO-02) Able to analyze the quality of services in the internet network and do troubleshooting if there are problems in the network.

(CPMK-03) Mampu menggunakan tool dan software admin jaringan untuk memanajemen jaringan termasuk security jaringan dan pembagian bandwidth
(CLO-03) Able to use network admin tools and software to manage networks including network security and bandwidth sharing.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki.
(CLO-04) Demonstrate the attitude of being responsible for work in his area of expertise independently.
Working together to be able to make the most of their potential.

Topik/Pokok Bahasan
Main Subjects

1. Konsep dan sejarah internet
   Internet Concept and History
2. Client server

Client server

3. Arsitektur Internet
   Internet Arsitecture
4. Protocol Internet
   Internet Protocol
5. Routing
   Routing
6. Router Design
   Router Design
7. IP Switching
   IP Switching
8. IPv6
   *IPv^*
9. Mobility
   Mobility

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

10.

Pustaka
Reference(s)

[1] D. Comer, Internetworking With TCP/IP, Volume 1: Principles Protocols, and Architecture, 5th edition, 2006.
[2] D. Medhi and K. Ramasamy, Network Routing, Mogran Kaufmann, 2007.
[3] M. Hassan and R. Jain, High Performance TCP/IP Networking: Concepts, Issues, and Solutions, Prentice-Hall, 2003.
[4] G. Varghese, Network Algorithmics, Mogran Kaufmann, 2004.

Prasyarat ***Prerequisite(s)***
- EE184302 Dasar Sistem dan Jaringan Telekomunikasi *EE184302 Introduction to Telecommunication Systems and Networks* - EE184533 Rekayasa Trafik *EE184533 Networks and Traffic Engineering* - EE184934 Layanan Dalam jaringan *EE184934 Services over Networks*

Mata Kuliah ***Course***	Nama MK *Name*	:	Pengolahan Sinyal Multimedia *Multimedia Signal Processing*
	Kode MK *Code*	:	EE184937
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Sri Rahayu, ST, M.Kom
	Pengajar *Lecturer*	:	Sri Rahayu, ST, M.Kom Dr.Ir. Wirawan, DEA
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Jaringan telekomunikasi dan internet membawa trafik yang sebagian besar adalah multimedia content, dengan pertumbuhan yang pesat dari tahun ke tahun. Pada mata kuliah ini mahasiswa akan mempelajari karakteristik, pembangkitan dan pengolahan berbagai jenis sinyal multimedia, antara lain: citra, video, suara, dan gabungannya. Selain itu akan dipelajari prinsip kompresi dari aspek teori informasi dan teori sinyal, serta teknik-teknik pengkodean modern. Berbagai metode pengkodean dan kompresi modern yang digunakan pada berbagai aplikasi juga dibahas, antara lain: JPEG, JPEG2000, MPEG-1/2/4, mp3.
Telecommunication and internet networks carry traffic, most of which are multimedia content, with rapid growth from year to year. In this course students will study the characteristics, generation and processing of various types of multimedia signals, including: image, video, sound, and combination. In addition, the principles of compression will be studied from aspects of information theory and signal theory, as well as modern coding techniques. Various modern coding and compression methods used in various applications are also discussed, including: JPEG, JPEG2000, MPEG-1/2/4, mp3.

CPL Prodi yang Dibebankan
Learning Outcomes

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

(PLO-01) Capable to apply knowledge of natural sciences and mathematics to solve electrical engineering problem

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by

considering safety, social, cultural, environmental and economic aspects

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep dan prinsip representasi dan pengkodean citra, video dan suara yang efisien dalam penggunaan sumber daya (memory dan laju bit) untuk komunikasi dan distribusi sinyal multimedia di jaringan.

(CLO-01) Mastering the concepts and principles of image, video and sound representation and coding that are efficient in the use of resources (memory and bitrate) for communication and distribution of multimedia signals on the network

(CPMK-02) Mampu menganalisis karakteristik dari citra, video dan suara dari sisi bandwidth, resolusi, distribusi greylevel dll serta mampu mendesain kompresi dan pengkodean sinyal multimedia sesuai persyaratan bandwidth, kualitas dan kompleksitas.

(CLO-02) Able to analyze the characteristics of image, video and sound in terms of bandwidth, resolution, distribution of grey level etc. as well as able to design compression and encoding multimedia signals according to bandwidth, quality and complexity requirements.

(CPMK-03) Mampu menggunakan perangkat lunak dan tool pengkodean multimedia, misal: Matlab dan VcDemo dll untuk melakukan analisis dan pengkodean sinyal-sinyal multimedia.

(CLO-03) Able to use software and multimedia coding tools, for example: Matlab and VcDemo etc. to analyze and encode multimedia signals.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri
(CLO-04) Show an attitude of responsibility for work in his area of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Pengantar tentang contoh dan aplikasi pengolahan dan pengiriman multimedia
   Introduction to examples and applications for multimedia processing and shipping
2. Representasi berbagai jenis citra digital
   Representation of various types of digital imagery
3. Cahaya, warna dan sistem penglihatan manusia
   Light, color and human vision system
4. Dasar-dasar sinyal video analog dan digital
   Basics of analog and digital video signals
5. Kompresi tanpa rugi-rugi dan dasar-dasar teori informasi
   Compression without losses and the basics of information theory
6. Kompresi dengan rugi-rugi, kuantisasi, pengkodean transformasi: DCT
   Compression with losses, quantization, transformation coding: DCT
7. Kompresi citra
   Image compression
8. Prinsip dasar kompresi video
   The basic principle of video compression
9. Standar kompresi video
   Standard video compression
10. Dasar-dasar audio, wicara
    Audio basics, speech
11. Kompresi audio digital
    Digital audio compression

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

12.

Pustaka
Reference(s)

[1] Ze-Nian Li, Mark S. Drew, & Jiangchuan Liu, "Fundamentals of Multimedia," 2nd ed., Springer, 2014
[2] Parag Havaldar & Gérard Medioni, "Multimedia Systems: Algorithms, Standards, & Industry Practices," Cengage Learning, 2010.
[3] Srdjan Stankovic, Irena Orovic, & Ervin Sejdic, "Multimedia Signals and Systems: Basic and Advanced Algorithms for Signal Processing," 2nd ed., Springer, 2016.

Prasyarat
Prerequisite(s)

EE184403 Pengolahan Sinyal Digital
EE184403 Digital Signal Processing

Mata Kuliah ***Course***	Nama MK *Name*	:	Jaringan Sensor Nirkabel dan IoT *Wireless Sensor Network and Internet of Things (IoT)*
	Kode MK *Code*	:	EE184938
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Eko Setijadi, ST, MT, PhD
	Pengajar *Lecturer*	:	Eko Setijadi, ST, MT, PhD
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Berkat pertumbuhan yang pesat teknologi MEMS, nano dan sistem komunikasi nirkabel, perangkat sensor dan transceiver menjadi semakin kecil, murah dan dapat digelar pada jumlah yang banyak untuk berbagai aplikasi yang beragam: kesehatan, pertanian, pemantauan struktur, smart grid, dll. Pada mata kuliah ini mahasiswa akan mempelajari prinsip dasar dan teknik terkait dari jaringan sensor nirkabel dan IoT, yaitu: arsitektur simpul, physical layer, protokol MAC, protokol routing dan jaringan, sekuriti, dan manajemen enerji. Selain itu pada perkuliahan akan diimplementasikan mode dan konsep JSN dan IoT yang dipelajari pada perangkat yang ada.

The course discuss the development of MEMS, nano technology and wireless communication systems, sensor devices and transceivers are becoming smaller, cheaper and can be deployed in large quantities for a variety of diverse applications: health, agriculture, structural monitoring, smart grids, etc. In this course students will learn the basic principles and related techniques of wireless sensor networks and IoT, namely: node architecture, physical layer, MAC protocol, routing and network protocols, security, and energy management. In addition, in the lecture, modes and concepts of JSN and IoT will be implemented that are learned on existing devices.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep dan teknik-teknik pada jaringan sensor nirkabel dan IoT, yaitu: arsitektur perangkat, protokol MAC dan jaringan, konsep penginderaan spasial, agregasi dan komputasi data terdistribusi, serta contoh-contoh aplikasinya.
(CLO-01) Mastering the concepts and techniques of wireless sensor and IoT networks, namely: device architecture, MAC and network protocols, the concept of spatial sensing, aggregation and computation of distributed data, and examples of their applications.

(CPMK-02) Mampu menjelaskan prinsip kerja dari perangkat JSN dan Iot, protokol-protokol untuk jaringan nirkabel ad hoc serta mampu menganalisis unjuk kerja JSN dan IoT dari aspek kapasitas, throughput, dan penggunaan enerji.
(CLO-02) Able to explain the working principles of JSN and Iot devices, protocols for ad hoc wireless networks and be able to analyze JSN and IoT performance in terms of capacity, throughput and energy use.

(CPMK-03) Mampu menggunakan perangkat lunak dan tool untuk simulasi dan pengembangan JSN dan IoT, misal: Matlab, TinyOS, ns-3.
(CLO-03) Able to use software and tools for JSN and IoT simulation and development, for example: Matlab, TinyOS, ns-3.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri
(CLO-04) Show an attitude of responsibility for work in his area of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Pengantar tentang perkembangan, contoh dan aplikasi jaringan sensor nirkabel dan IoT
   Introduction to developments, examples and applications of wireless sensor networks and IoT
2. Faktor-faktor penting pada desain JSN dan IoT
   Important factors in JSN and IoT design
3. Arsitektur simpul JSN
   JSN node architecture
4. Lapisan fisik
   Physical layer
5. Lapisan Medium Access Control (MAC)
   Medium Access Control (MAC) Layer
6. Lapisan jaringan
   Network layer
7. Algoritma-algoritma hemat enerji
   Energy saving algorithms
8. Teknik-teknik lokalisasi
   Localization techniques
9. Arsitektur sistem IoT dan perangkat
   IoT system architecture and devices
10. Integrasi dan interoperabilitas dari sistem-sistem IoT
    Integration and interoperability of IoT systems
11. Keamanan pada JSN dan IoT
    Security on JSN and IoT

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

12.

Pustaka
Reference(s)

[1] Waltenegus Dargie & Christian Poellabuer, "Fundamentals of Wireless Sensor Networks: Theory and Practice," 2nd ed., Wiley, 2010.
[2] Ian F. Akyildiz & Mehmet Can Vuran, "Wireless Sensor Networks," Wiley, 2010.
[3] Dimitrios Serpanos & Marilyn Wolf, "Internet-of-Things (IoT) Systems: Architectures, Algorithms and Methodologies," Springer, 2018.

Prasyarat
Prerequisite(s)

EE184302 Dasar Sistem dan Jaringan Telekomunikasi
EE184302 Introduction to Telecommunication Systems and Networks

Mata Kuliah ***Course***	Nama MK *Name*	:	Jaringan Satelit dan Pengindraan Jauh *Satellite Network and Remote Sensing*
	Kode MK *Code*	:	EE184939
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Prof. Dr.Ir. Gamantyo Hendrantoro, M.Eng
	Pengajar *Lecturer*	:	Prof. Dr.Ir. Gamantyo Hendrantoro, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Jaringan Satelit dan Penginderaan Jauh membahas dua topik. Di bagian pertama, mahasiswa belajar tentang dasar teori dan perancangan sistem dan jaringan satelit, dengan fokus pada satelit komunikasi dan satelit untuk penginderaan jauh. Di bagian kedua, mahasiswa belajar mengenai berbagai sistem dan metode penginderaan jauh, dengan fokus pada konsep teknologi dan aplikasinya.

Satellite Networking and Remote Sensing courses cover two topics. In the first part, students learn about the basic theory and design of satellite systems and networks, focusing on communication satellites and satellites for remote sensing. In the second part, students learn about various remote sensing systems and methods, focusing on the concepts of technology and their applications.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-5) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep jaringan satelit dan penginderaan jauh.
(CLO-01) Mastering the concept of satellite networks and remote sensing.

(CPMK-02) Mampu mendesain link komunikasi satelit, jaringan satelit, dan sistem penginderaan jauh.
(CLO-02) Able to design satellite communication links, satellite networks, and remote sensing systems.

(CPMK-03) Mampu melakukan perhitungan link budget yang akurat dengan bantuan perangkat lunak.
(CLO-03) Able to do accurate link budget calculations with the help of software.

(CPMK-04) Mampu menunjukkan sikap bertanggung jawab dalam mendesain jaringan satelit dan sistem penginderaan jauh dengan baik dan benar.
(CLO-04) Able to show a responsible attitude in designing satellite networks and remote sensing systems properly and correctly.

Topik/Pokok Bahasan

Main Subjects

1. Konsep, sistem, dan subsistem satelit
   Satellite concepts, systems and subsystems
2. Orbit satelit dan pengarahan antena stasiun bumi
   Satellite orbit and direction of earth station antenna
3. Link budget untuk komunikasi satelit
   Link budget for satellite communication

4. Konstelasi satelit dan jaringan satelit multi-beam
   Satellite constellations and multi-beam satellite networks
5. Sistem komunikasi akses jamak dan interferensi
   Multiple access and interference communication systems
6. Konsep (interaksi gelombang elektromagnetik dan obyek) dan sistem penginderaan jauh
   Concepts (electromagnetic wave interactions and objects) and remote sensing systems
7. Penginderaan jauh berbasis satelit
   Satellite based remote sensing
8. Fotografi udara
   Aerial photography
9. Radar dan lidar
   Radar and lidar
10. Citra termal
    Thermal imagery
11. Aplikasi penginderaan jauh
    Remote sensing application

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

12. *Final examination*

Pustaka
Reference(s)

[1] Dennis Roddy, Satellite Communications, ed. 4, McGraw-Hill, 2006.
[2] Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, ed. 2, Wiley, 2002.

[3] Erich Lutz, Markus Werner, Axel Jahn, Satellite Systems for Personal and Broadband Communications, Springer-Verlag, 2000.
[4] James Campbell, Randolph Wynne, Introduction to Remote Sensing, ed. 5, Guilford Press, 2011.
[5] Arthur Cracknell, Ladson Hayes, Introduction to Remote Sensing, ed. 2, Taylor and Francis, 2007.

Prasyarat
Prerequisite(s)

- EE184531 Sistem Komunikasi I
  EE184531 Communication Systems I
- EE184632 Propagasi Gelombang
  EE184632 Wave Propagation
- EE184532 Transmisi Gelombang Elektromagnetik dan Antena
  EE184532 Electromagnetic Wave Transmission and Antennas

Mata Kuliah ***Course***	Nama MK *Name*	:	Dasar Sistem Elektronika Cerdas *Basic Intelligent Electronic System*
	Kode MK *Code*	:	EE184940
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Eng Mohammad Attamimi B. Eng. M. Eng
	Pengajar *Lecturer*	:	Dr. Eng Mohammad Attamimi B. Eng. M. Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Dasar Sistem Elektronika Cerdas mempelajari prinsip dasar dari komponen-komponen dalam sistem cerdas seperti machine learning (neural network, visual recognition), machine reasoning (fuzzy system), dan optimisasi (genetic algorithm). Dalam kuliah ini juga mempelajari desain dari sistem elektronika cerdas untuk aplikasi tertentu dan mengimplementasikan sistem cerdas dalam embedded system berbasis mikrokontroler (raspberry pi, arduino atau yang lainnya).

Basic Intelligent Electronic System course discusses the basic principles of components in intelligent systems such as machine learning (neural network, visual recognition), machine reasoning (fuzzy system), and optimization (genetic algorithm). In this lecture, the design of intelligent electronics systems for particular applications, and an implementation of intelligent systems in microcontroller-based embedded systems (e.g., raspberry pi, Arduino, and so forth), will also be studied.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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 prinsip dasar dari komponen-komponen dalam sistem cerdas.
(CLO-01) Mastering the basic principles of the components in an intelligent system.

(CPMK-02) Mampu mendesain dan merealisasikan sistem elektronika cerdas untuk aplikasi tertentu.
(CLO-02) Able to design and realize intelligent electronics systems for specific applications.

(CPMK-03) Mampu menggunakan perangkat elektronika dan perangkat lunak untuk mewujudkan sebuah sistem cerdas.
(CLO-03) Able to use electronic devices and software to realize an intelligent system.

(CPMK-04) Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri.
(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Topik/Pokok Bahasan
Main Subjects

1. Dasar-dasar neuroscience dan pemodelan neuron, model neural network feedforward dan feedback propagation
   Fundamentals of neuroscience and neuron modeling, neural network feedforward model and feedback propagation.
2. Metode pembelajaran neural network
   Learning methods in neural network.
3. Topik dalam rekognisi visual

Topics on visual recognition.

4. Fuzzy logic dan fuzzy inference system
   Fuzzy logic and fuzzy inference system.
5. Genetic algorithm
   Genetic algorithm.
6. Desain dan implementasi sistem elektronika cerdas
   Design and implementation of intelligent electronics systems.

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
7. - *Final examination*

Pustaka
Reference(s)

[1] NK Bose, and P. Liang, “Neural Network Fundamental”, McGraw Hill Inc., 1996.
[2] Frederic M Hum, and Ivica Kostanic, “Principles of Neurocomputing for Science & Engineering”, McGraw Hill Inc., 2001.
[3] JSR Jang, CT Tsun, “Neuro-Fuzzy and Soft Computing”, Prentice Hall Inc., 1997.
[4] T. Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill Inc., 1995.
[5] David B Fogel, “Evolutionary Computation”, IEEE Press.

Prasyarat
Prerequisite(s)

EW184004 Metode Numerik
EW184004 Numerical Methods

Mata Kuliah ***Course***	Nama MK *Name*	:	Divais Optoelektronika *Optoelectronic Devices*
	Kode MK *Code*	:	EE184941
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Mohammad Rivai, ST, MT
	Pengajar *Lecturer*	:	Dr. Mohammad Rivai, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah Divais Optoelektronika membahas tentang Sifat cahaya meliputi polarisasi, interferensi, difraksi, spektrum cahaya, monokromator; Modulasi cahaya; Divais Displai meliputi Light Emitting Diode, Plasma Display, Liquid Crystal Display; Laser meliputi teknik pembangkitan laser, Q-switching; Photodetector meliputi Photocathode, UVTRON, Photomultiplier, Photoconductive, Photodiode, Photovoltaic, Charge Couple Device; Serat optik meliputi Fiber Dispersions, Multimode step-index fiber, Inter-modal dispersion, Single-mode fiber, Graded-index fiber, Material Dispersion, Fiber Losses, Optical Time-Domain Reflector; Optika terpadu meliputi Waveguide Fabrication, Directional Coupler, splitter, Wavelength multiplexer, Interferometric Filter, Optical switch, Optical amplifier; Sistem komunikasi optik; Aplikasi divais optoelektronika dan teknologi laser.

The course of Optoelectronic Device discusses: The Properties of Light including Polarization, Interference, Diffraction, Light Spectrum, and Monochromator; Modulation of Light; Display Devices including Light Emitting Diode, Plasma Display, Liquid Crystal Display; Lasers including Laser Stimulation Techniques, Q-Switching; Photodetectors including Photocathode, UVTRON, Photomultiplier, Photoconductive, Photodiode, Photovoltaic, Charge-coupled Device; Optical Fibers including Fiber Dispersions, Multimode Step-index Fibers, Inter-modal Dispersion, Single-mode Fiber, Graded-index Fiber, Material Dispersion, Fiber Losses, Optical Time-Domain Reflector; Integrated Optics including Waveguide Fabrication, Directional Coupler, Splitter, Wavelength Multiplexer, Interferometric Filter, Optical Switch, Optical Amplifier; Optical Communication System; Applications of Optoelectronic Devices.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan

mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep, prinsip dan prosedur perancangan sistem teknologi berbasis divais optoelektronika serta pemanfaatannya pada sistem telekomunikasi multimedia atau elektronika

(CLO-01) Mastering the concepts, principles of design procedure for optoelectronic device technology systems and its applications in telecommunications or electronics.

(CPMK-02) Mampu mendeskripsikan rancangan sistem teknologi berbasis divais optoelektronika untuk penyelesaian permasalahan rekayasa pada telekomunikasi multimedia, atau elektronika

(CLO-02) Able to describe the analysis, simulation, design, and application of optoelectronic devices.

(CPMK-03) Mampu menerapkan proses analisis, perancangan dan deskripsi aplikasi divais optoelektronika dalam konteks pengembangan atau implementasi ilmu pengetahuan dan teknologi yang memperhatikan dan menerapkan nilai humaniora yang sesuai dengan bidang keahliannya

(CLO-03) Able to apply the process of analysis, design and application description of optoelectronic devices in the context of the development

or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise.

(CPMK-04) Menunjukkan sikap bertanggungjawab yang berkenaan dengan proses analisis, perancangan dan deskripsi aplikasi divais optoelektronika secara mandiri.
(CLO-04) Demonstrating attitude of responsibility regarding the analysis, simulation, design, and application of optoelectronic devices independently.

Topik/Pokok Bahasan
Main Subjects

1. Sifat cahaya
   The Properties of Light
2. Modulasi cahaya
   Modulation of Light
3. Divais Displai
   Display Devices
4. Laser
   Lasers
5. Photodetector
   Photodetectors
6. Serat optic
   Optical Fibers
7. Optika terpadu
   Integrated Optics
8. Sistem komunikasi optic
   Optical Communication System
9. Aplikasi divais optoelektronika dan teknologi laser
   Applications of Optoelectronic Devices

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

10. *Final examination*

Pustaka
Reference(s)

[1] Muhammad Rivai, 2018. Diktat: Divais Optoelektronika.
[2] S.O. Kasap, 2012. Optoelectronics & Photonics: Principles & Practices, Prentice Hall.

Prasyarat
Prerequisite(s)

EE184303 Medan Elektromagnetik
EE184303 Electromagnetic Field

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Kontrol Elektronika *Electronic Control System*
	Kode MK *Code*	:	EE184942
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	PIlihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr.Ir. Djoko Purwanto, M.Eng
	Pengajar *Lecturer*	:	Dr.Ir. Djoko Purwanto, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Sistem kontrol elektronika membahas tentang metoda perancangan sistem kontrol elektronika dan realisasinya baik secara analog maupun secara digital. Metoda perancangan sistem kontrol meliputi metoda klasik dan metoda modern. Sistem identifikasi untuk mendapatkan model plant yang akan dipakai dalam perancangan sistem kontrol, juga dibahas dalam kuliah ini. Realisasi sistem kontrol secara analog dilakukan dengan menggunakan rangkaian op-amp. Realisasi sistem kontrol secara digital dilakukan dengan mikrokomputer (personal komputer dan mikrokontroler).

Electronic control system discusses electronics control system design methods and their implementations both analog and digital. Control system design methods include classical and modern methods. The identification system to obtain the plant model to be used in control system design is also discussed in this course. The implementations of analog control system are done by using op-amp circuit. The implementations of digital control system are done by microcomputer (personal computer and microcontroller).

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep perancangan dan realisasi sistem kontrol elektronika baik secara analog maupu secara digital.
(CLO-01) Mastering the concept of design and implementation of electronic control systems either analog or digital.

(CPMK-02) Mampu merancang dan merealisasikan sistem kontrol elektronika secara analog berbasis rangkaian op-amp dan secara digital berbasis mikrokomputer.
(CLO-02) Able to design and implement analog electronic control system based on op-amp circuit and digital control system based on microcomputer.

(CPMK-03) Mampu menyelesaikan perancangan dan realisasi sistem elektronika untuk aplikasi tertentu.
(CLO-03) Able to complete the design and implementation of electronic systems for specific applications.

(CPMK-04) Mampu menggunakan perangkat TIK untuk merancang sistem dan perangkat elektronika untuk merealisasikan sistem.
(CLO-04) Able to use ICT devices to design electronics systems and devices to implement the system.

(CPMK-05) Menunjukkan sikap bekerja secara mandiri, kreatif, dan inovatif dalam pemecahan masalah.

(CLO-05) Demonstrating self-reliance, creative, and innovative in problem solving.

Topik/Pokok Bahasan
Main Subjects

1. Dasar perancangan sistem kontrol
   Basic design of control system
2. Perancangan sistem kontrol PID
   Design of PID control system
3. Perancangan sistem kontrol logika fuzzy
   Design of fuzzy logic control system
4. Realisasi Sistem identifikasi
   Implementation of identification system
5. Perancangan sistem kontrol dengan metoda aljabar linear
   Design of control system with linear algebra method
6. Perancangan sistem dengan metoda observasi gangguan
   System design with interference observation method
7. Realisasi sistem kontrol analog
   Implementation of analog control system
8. Realisasi sistem kontrol digital
   Implementation of digital control system

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
9. - *Final examination*

Pustaka
Reference(s)

[1] Cheng Siong Chin, Computer-Aided Control Systems Design, CRC Press, 2013.

[2] Jan Jantzen, Foundations of Fuzzy Control: a Practical Approach (2nd Edition), John Wiley & Sons, 2013.
[3] Ioan D. Landau and Gianluca Zito, Digital Control Systems: Design, Identification and Implementation, Springer-Verlag, 2006.
[4] Dogan Ibrahim, Microcontroller-Based Applied Digital Control, John Wiley & Sons, 2006.
[5] Chi-Tsong Chen, Analog and Digital Control System Design, Saunders College Publishing, 2005.

Prasyarat
Prerequisite(s)

EE184404 Dasar Sistem Pengaturan
EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Instrumentasi Elektronika *Electronic Instrumentation*
	Kode MK *Code*	:	EE184943
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir. Harris Pirngadi, MT
	Pengajar *Lecturer*	:	Ir. Harris Pirngadi, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mata kuliah sensor dan aktuator membahas tentang prinsip kerja sistem elektronik yang diaplikasikan pada peralatan rumah tangga dan automotive. Peralatan rumah tangga yang menjadi topik bahasan meliputi pemancar dan penerima radio, pemancar dan penerima televisi, Air conditioning (AC) dan perangkat multimedia. Pada bidang automotive meliputi Capacitor Discharge Ignition (CDI), Electronic Fuel Injection (EFI) dan Mobil Listrik.

Electronic Instrumentation course discusses the working principle of electronic systems applied to home appliances and automotive. Home appliances topics include radio transmitters and receivers, television transmitters and receivers, Air conditioning (AC) and multimedia devices. In the field of automotive, the topics include Capacitor Discharge Ignition (CDI), Electronic Fuel Injection (EFI) and Electric Car.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-06) Mampu mematuhi hukum dan perataruran yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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) Mampu menjelaskan konsep dasar sistem elektronika yang diaplikasikan pada peralatan rumah tangga dan automotive.
(CLO-01) Able to explain the basic concepts of electronics systems applied to home appliances and automotive.

(CPMK-02) Mampu menganalisis spesifikasi dan permasalahan pada sistem elektronik yang diaplikasikan pada perangkat rumah tangga dan automotive.
(CLO-02) Able to analyze the specifications and problems in electronic systems applied to household devices and automotive.

(CPMK-03) Mampu mengambil keputusan dalam pemilihan produk elektronik pada peralatan rumah tangga dan automotive.
(CLO-03) Able to make decisions in the selection of electronic products on home appliances and automotive.

(CPMK-04) Mampu bekerja secara mandiri dan kelompok dalam melaksanakan tugas dan tanggung jawabnya.
(CLO-04) Demonstrating attitude of responsibility on work in his/her field of expertise independently in term of Electronic Instrumentation.

Topik/Pokok Bahasan

Main Subjects

1. Sejarah perkembangan teknologi radio.
   History of radio technology development.
2. Prinsip kerja pemancar radio.
   The working principle of radio transmitters.
3. Prinsip kerja penerima radio.
   The working principle of the radio receiver.

4. Jenis – jenis radio.
   Types of radio.
5. Prinsip kerja penerima televisi.
   The working principle of television receiver.
6. Jenis – jenis televisi
   Types of television
7. Prinsip kerja dvd dan audio amplifier.
   The working principle of dvd and audio amplifier.
8. Prinsip kerja air conditioning (ac)
   The working principle of air conditioning (ac)
9. Jenis – jenis ac
   Types of AC
10. Sistem cdi pada automotive.
    CDI system in automotive.
11. Sistem efi pada automotive
    EFFI system on automotive
12. Sistem mobil listrik.
    Electric car system.

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] Fischer, W. (2008). Digital Video and Audio Broadcasting Technology A Practical Engineering Guide. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg.

Prasyarat

Prerequisite(s)
EE184306 Rangkaian Elektronika *EE184306 Electronic Circuits*

Mata Kuliah ***Course***	Nama MK *Name*	:	Penginderaan Visual Elektronika
	Kode MK *Code*	:	EE184944
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr. Ronny Mardiyanto, ST, MT
	Pengajar *Lecturer*	:	Dr. Ronny Mardiyanto, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Mempelajari tentang penginderaan visual elektronika (persepsi visual sebuah gambar) menggunakan kamera yang meliputi teknik akuisisi gambar dengan kamera, pengolahan gambar, analisis gambar, dan pemahaman gambar berbasis perangkat system on chip (Raspberry Pi). Aplikasi yang digunakan adalah untuk membuat pemisah benda berdasarkan warna, pengenalan wajah, penghitung kendaraan, pendeteksi obyek bergerak dan aplikasi lainnya.

This course studies the visual sensing of electronics (visual perception of an image) using a camera that includes image acquisition techniques with cameras, image processing, image analysis, and image-based understanding of on chip system devices (Raspberry Pi). The common applications widely used to create object separators by color, facial recognition, vehicle counters, moving objects detection and others.

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(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 teknik akuisisi gambar menggunakan kamera, teknik segmentasi gambar, teknik pengenalan gambar, teknik pemahaman gambar, dan perangkat keras yang digunakan pada machine vision

(CLO-01) Understand the technique of image acquisition, segmentation, recognition, image understanding, and hardware used in machine vision.

(CPMK-02) Mampu menggunakan teknik segmentasi gambar, teknik pengenalan gambar, teknik pemahaman gambar, perangkat keras yang digunakan pada machine vision.

(CLO-02) the technique of image acquisition, segmentation, recognition, image understanding, and hardware used in machine vision.

(CPMK-03) Mampu menggunakan perangkat lunak Visual Studio dan perangkat lunak OpenCv.

(CLO-03) Able to use Visual Studio, OpenCv Library.

(CPMK-04) Mampu menginternalisasi semangat kemandirian, kejuangan, dan kewirausahaan

(CLO-04) Able to internalize the spirit of independence, struggle, and entrepreneurship.

Topik/Pokok Bahasan

Main Subjects

1. Definisi, kegunaan, dan aplikasi pengolahan citra
   Introduction of machine vision
2. Perangkat yang digunakan untuk pengolahan citra

Device used for machine vision

3. Pengolahan Citra Biner: (1) Threshold, (2) Adaptive Threshold, (3) Histogram, (4) Deteksi Tepi, (5) Analisis Blob, (6) Kompresi Citra, (7) Background Substraction, (8) Filter, (9) Contour
   Binary Image Processing: (1) Threshold, (2) Adaptive Threshold, (3) Histogram, (4) Edge Detection, (5) Blob Analysis, (6) Image Compression, (7) Background Subtraction, (8) Filter, (9) Contour
4. Fitur pada Citra: (1) Edge, (2) Corner, (3) Point
   Features: (1) Edge, (2) Corner, (3) Points
5. Template Matching: (1) SAD, (2) SSD, (3) Cross Corelation, (4) Cross Corellation Coefficient
   Template Matching: (1) SAD, (2) SSD, (3) Cross Correlation, (4) Cross Correlation Coefficient
6. Motion Analysis, Mean Shift
   Motion Analysis, Mean Shift
7. Pattern Analysis, PCA, Gabor Filter,LBP, Viola Jones
   Pattern Analysis, PCA, Gabor Filter, LBP, Viola Jones

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

8. - *Final examination*

Pustaka
Reference(s)

[1] Buku Ajar Penginderaan Visual Elektronika, Ronny Mardiyanto, 2018
[2] Linda G. Shapiro, Computer Vision, Prentice-Hall, Inc., 2001
[3] Milan Sonka dkk, Image Processing: Analysis, and Machine Vision, Brooks and Cole Publishing, 1998.

[4] Ramesh Jain, Machine Vision, McGraw-Hill, Inc., 1995
[5] Gary Bradski and Adrian Kaehler, Learning OpenCV: Computer Vision with OpenCV Library, O'Reilly Media, Inc., 2008

Prasyarat
Prerequisite(s)

EW184004 Metode Numerik
EW184004 Numerical Method

Mata Kuliah ***Course***	Nama MK *Name*	:	Sistem Robot Otonom *Autonomous Robot System*
	Kode MK *Code*	:	EE184945
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	Pilihan *Elective*
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Dr.Ir. Djoko Purwanto, M.Eng
	Pengajar *Lecturer*	:	Dr.Ir. Djoko Purwanto, M.Eng
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

Sistem robot otonom (autonomous robot system) mempelajari tentang manipulators, mobile robot, autonomous flying robot, dan autonomous surface vessel. Pada manipulators dipelajari tentang redundant dan hyper-redundant manipulator beserta teknik kontrolnya. Pada mobile robot dipelajari tentang model, trajectoty-tracking control, formation control, motion planning, dan navigation. Hal yang dipelajari pada moble robot, dipelajari pula untuk autonomous flying robot, dan autonomous surface vessel.

Autonomous robot systems learn about manipulators, mobile robots, autonomous flying robots, and autonomous surface vessels. In the manipulators, students study about redundant and hyper-redundant manipulators and their control techniques. In the mobile robot, students study about the model, trajectory-tracking control, formation control, motion planning, and navigation. In mobile robots, students also study autonomous flying robots, and autonomous surface vessels.

CPL Prodi yang Dibebankan

Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(CPL-06) Mampu mematuhi hukum dan peratururan yang berlaku, etika profesi dan bertanggung jawab pada bidang kerjanya dengan mempertimbangkan konteks global, ekonomi, lingkungan, dan sosial

(PLO-06) Capable to comply with applicable laws and regulations, professional ethics and be responsible for the field of work taking into account the global, economic, environmental and social context.

(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

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai konsep robot otonom (autonomous robot) dan aplikasinya

(CLO-01) Mastering the concept of autonomous robots and its application.

(CPMK-02) Mampu memahami konsep robot otonom berupa manipulators, mobile robot, autonomous flying robot, dan autonomous surface vessel

(CLO-02) Able to understand the concept of autonomous robots in the form of manipulators, mobile robot, autonomous flying robot, and autonomous surface vessel.

(CPMK-03) Mampu mengerjakan rancang bangun sistem robot otonom untuk aplikasi tertentu.

(CLO-03) Able to design autonomous robotic systems for specific applications.

(CPMK-04) Menunjukkan sikap mandiri, kreatif, dan inovatif dalam pemecahan masalah

(CLO-04) Demonstrating self-reliance, creative, and innovative in problem solving.

Topik/Pokok Bahasan

Main Subjects

1. Sistem Robot Otonom
   Autonomous Robot System
2. Manipulators
   Manipulators

3. Mobile robot
   Mobile robot
4. Autonomous flying robot
   Autonomous flying robot
5. Autonomous Surface vessel
   Autonomous Surface vessel

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

6.

Pustaka
Reference(s)

[1] Lounis Adouane, Autonomous Vehicle Navigation: From Behavioral to Hybrid Multi-Controller Architectures, Taylor & Francis Group LLC, 2016.
[2] Farbod Fahimi, Autonomous Robots: Modeling, Path Planning, and Control, Springer Science+Business Media LLC, 2009.
[3] Kenzo Nonami, Farid Kendoul, Satoshi Suzuki, Wei Wang, Daisuke Nakazawa, Autonomous Flying Robots: Unmanned Aerial Vehicles and Micro Aerial Vehicles, Springer-Verlag, 2006.

Prasyarat
Prerequisite(s)

- EE184401 Sistem Digital dan Mikroprosesor
  EE184401 Digital and Microprocessor Systems
- EE184404 Dasar Sistem Pengaturan
  EE184404 Introduction to Control Systems

Mata Kuliah ***Course***	Nama MK *Name*	:	Topik Khusus *Special Topic*
	Kode MK *Code*	:	EE184802
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	-
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Ir.Gatot Kusrahardjo, MT
	Pengajar *Lecturer*	:	Ir.Gatot Kusrahardjo, MT Sri Rahayu, ST, M.Kom
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah
Description of Course

CPL Prodi yang Dibebankan
Learning Outcomes

(CPL-05) Mampu mengidentifikasi, memformulasikan dan menyelesaikan permasalahan dibidang teknik elektro

(PLO-05) Capable to identify, formulate, and solve problems in the field of electrical engineering

(CPL-07) Mampu berkomunikasi secara efektif baik dalam bentuk tulisan maupun lisan

(PLO-07) Capable to communicate effectively both in written and oral form

(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

Capaian Pembelajaran Mata Kuliah
Course Learning Outcomes

Topik/Pokok Bahasan
Main Subjects

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)***

Prasyarat ***Prerequisite(s)***

Mata Kuliah ***Course***	Nama MK *Name*	:	Internship *Internship*
	Kode MK *Code*	:	EE184803
	Kredit *Credits*	:	3 sks
	Semester *Semester*	:	-
	Beban Belajar *Workload*	:	Kuliah : 3 x 50 = 150 menit/minggu Latihan/tugas : 3 x 60 = 180 menit/minggu Belajar mandiri : 3 x 60 = 180 menit/minggu *Lectures : 3 x 50 = 150 min/week* *Exercises/Assignments : 3 x 60 = 180 min/week* *Self learning : 3 x 60 = 180 min/week*
	Tingkatan *Module Level*	:	Sarjana (S1) *Undergraduate*
	Penanggung Jawab *PIC*	:	Eka Iskandar, ST, MT
	Pengajar *Lecturer*	:	Eka Iskandar, ST, MT
	Bahasa *Language*	:	Bahasa Indonesia dan Bahasa Inggris *Bahasa Indonesia and English*
	Persyaratan dan Peraturan *Requirement and Regulation*	:	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian *A student must have attended at least 75% of the lectures to sit in the exams*

Deskripsi Mata Kuliah ***Description of Course***

CPL Prodi yang Dibebankan
Learning Outcomes

Capaian Pembelajaran Mata Kuliah
Course Learning Outcomes

Topik/Pokok Bahasan
Main Subjects

Pembelajaran dan ujian
Study and examination

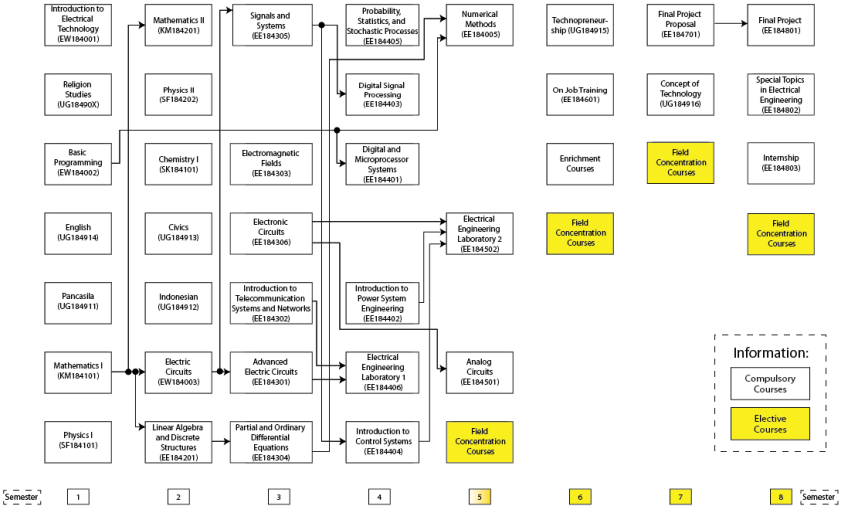
- Latihan di kelas
  In-class exercises
- Tugas 1, 2, 3
  Assignment 1, 2, 3
- Ujian tengah semester
  Mid-term examination
- Ujian akhir semester
- *Final examination*

Pustaka
Reference(s)

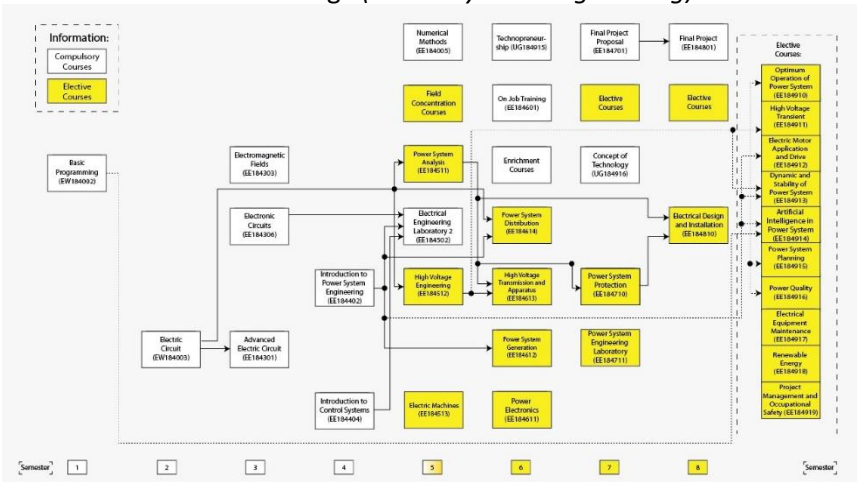
Prasyarat
Prerequisite(s)

VI Alur Pengambilan Mata Kuliah (*Course Flow*)

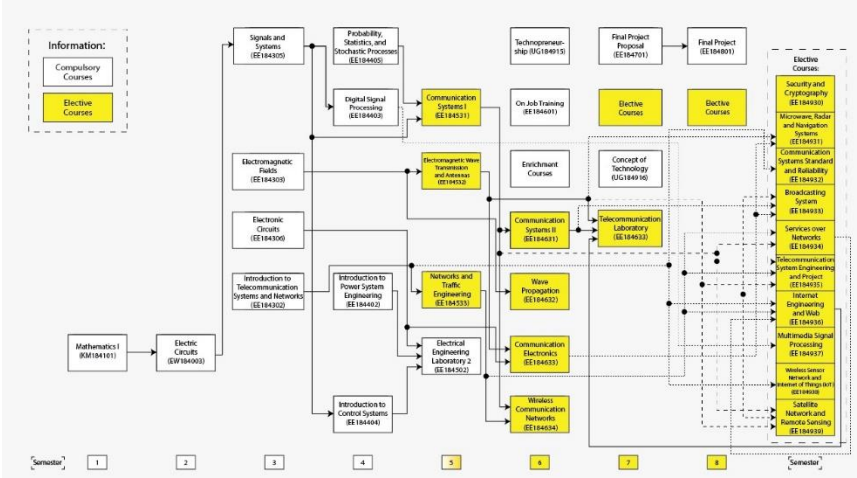
F. Mata Kuliah Dasar Elektro *(Common Electrical Engineering Courses)*



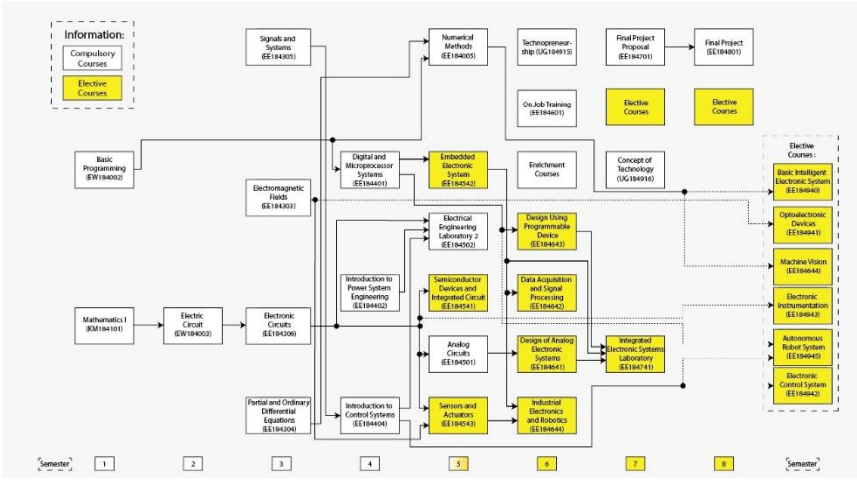
G. Teknik Sistem Tenaga *(Power System Engineering)*



H. Telekomunikasi Multimedia (*Multimedia Telecommunications*)



I. Elektronika (*Electronics*)



J. Teknik Sistem Pengaturan *(Control System Engineering)*