Dokumen Kurikulum 2013-2018

Program Studi : Magister Teknik Elektro

Lampiran I

Sekolah Teknik Elektro dan Informatika

Institut Teknologi Bandung

	Bidang Akademik dan Kemahasiswaan Institut Teknologi Bandung	Kode Dokumen		Total Halaman
		Kur2013-S2-EL		[159]
		Versi	[*23*]	5 September 2013

KURIKULUM ITB 2013-2018 – PROGRAM MAGISTER
Program Studi Magister Teknik Elektro
Sekolah Teknik Elektro dan Informatika

Silabus dan Satuan Acara Pengajaran (SAP) EL5000

Kode Matakuliah: EL5000	*Bobot sks:* 3	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Prodi

Nama Matakuliah	Matematika Lanjut

Silabus Ringkas	*Review* materi yang dibutuhkan untuk beberapa mata kuliah di Program Studi Magister Teknik Elektro

Silabus Lengkap	1. Aljabar Linier 2. Probabilitas and Statistik 3. Persamaan Differensial 4. Fourier Transform 5. Teori Graph 6. Feedback System

Luaran (Outcomes)	Mengerti materi dasar untuk digunakan pada kuliah dengan materi yang lebih dalam

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	Advanced Engineering Mathematics, 9th Edition by Erwin Kreyszig, 2006.
	Katsuhiko Ogata, "Modern Control Engineering (5th Edition)**,** Prentice Hall, 2009.
	George E. P. Box, "Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building", John Wiley & Sons, 1978

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Linear algebra	linear system of equations, rank, Cramer's rule, eigenvalues, eig envectors, orthogonal matrices, diagonalization, vector spa ce, inner product space, linear trans formation. Numerical examples.		
2	Vector calculus	grad, double integrals, Jacobian		
3	Differential equations	partial differentiation, separable, exact and linear equations, integrating factors, existence and uniqueness of solutions		
4	Second order differential equations	homogeneous and nonhomogeneous linear equations with constant coefficients, solution by undetermined coefficients, modelling of mechanical and		

		electrical systems.		
5	Fourier Series and Fourier integral	Periodic function, Trigonometric series, Fourier se ries, Functions of any period, Even and odd functions, Half-range Expansion, Forced oscilla tions, Fourier integral.		
6	Graphical and Quantitative Descriptive Statistics			
7	Probability Distribution Function			
8	Sampling Distributions & Confidence Intervals for Means			
9	Analysis of Variance & Linear Regression			
10	O-Notation and the Efficiency of Algorithms			
11	Relations & Graphs and Trees			
12	Concepts of Control	Output Feedback, State Feedback,		
13	Concepts of Control	State Feedback Matrix, Eigenvalue Place-ment and Controllability		
14	Concepts of Control	Controllable Canonic Form, Observer Design, Observability, Observerable Canonic Form		

Silabus dan Satuan Acara Pengajaran (SAP) EL5001

Kode Matakuliah: EL5001	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Kendali Optimal			
	Optimal Control			
Silabus Ringkas				
	Presents the theory and application of optimization, probabilistic modelling, and stochastic control to dynamic systems. Particular attention is given to modelling dynamic systems, measuring and controlling their behaviour, and developing strategies for future courses of action.			
Silabus Lengkap				
	Basics of Optimal regulator: standard regulator problem; tracking system, properties & applications of optimal control: classical interpretation of regulator system, asymptotical behaviour, choosing the quadratic weights, weighting optimal control design using state estimator, frequency shaping, controller order reduction.			
Luaran (Outcomes)				
Matakuliah Terkait	Sistem Kendali Multivariabel	Prasyarat		
Kegiatan Penunjang				
Pustaka	Stengel, R., Optimal Control and Estimation, Dover Publications, NY, 1994.			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	- Overview and Preliminaries - Minimization of Static Cost Functions			
2	Principles for Optimal Control of Dynamic System			
3	- Path Constraints and Numerical Optimization - Minimum-Time and Minimum-Fuel Trajectory Optimization			
4	- Neighbouring-Optimal Control - Dynamic System Stability			
5	- Linear-Quadratic Regulators - Cost Functions and Controller Structures			
6	- Linear-Quadratic Control of System Design - Modal Properties of LQ Systems			
7	**Ujian Tengah Semester**			
8	- Spectral Properties of LQ Systems - Singular-Value Analysis of LQ Systems			
9	- Probability and Statistics - Least Square Estimations of Static Systems			
10	- Propagation of Uncertainty in Dynamic Systems - State Estimation (Kalman Filter) for Discrete-Time Filter			
11	- State Estimation (Kalman-Bucy Filter) for Continuous Time Systems - Non linear state estimation (Extended Kalman Filter)			
12	- Nonlinear State Estimation (Sigma-Points Filtesr) - Adaptive State Estimation			
13	- Stochastic Optimal Control -Linear-Quadratic-Gaussian (LQG) Control			
14	**Ujian Akhir Semester**			

Silabus dan Satuan Acara Pengajaran (SAP) EL5002

Kode Matakuliah: EL5002	Bobot sks: 3	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Mekatronika			
	Mechatronics			
Silabus Ringkas	Pengenalan, kerangka umum dari mekatronik dan sistem kendali, elektronika untuk enggenir mesin, sistem mekanik untuk enggenir elektronika, pemodelan sistem mekatronik; penggerak elektrik, sistem elektrik dan elektronika daya. Perancangan sistem mekatronik			
	Introduction: general framework of mechatronics and control systems; Electronic for mechanical engineer; Mechanical Systems for electronics engineers; mechatronics system modeling, drives, electrical and power electronic			
Silabus Lengkap	Pengenalan: kerangka umum dari mekatronika dan sistem kontrol; konsep-konsep sensor, tranduser-tranduser, pengukuran-pengukuran; karakterisistik unjuk kerja dari mekatronika; sensor digital; akusisi data; aktuator dan penguat daya; komponen-komponen aktuator: aktuator mekanik, hidrolik, elektrik dan phenumatik; pemodelan sistim mekatronika: pemodelan diagram blok & pemodelan matematik; mekanika tranlasi dan mekanika rotasi; sistem fluida dan sistem termal. Mikrokontroler, PLC. Desain dan mekatronika			
	Introduction: general framework of mechatronics and control systems; sensor concepts, transducers, measurements; performance characteristics of mechatronics; digital sensors; data acquisition; actuators and power amplifiers; actuator components: mechanical, hydraulic, pneumatic and electric actuators; mechatronics system modelling: block diagram & mathematical modeling; translational and rotational mechanics; fluid and thermal systems. Microcontroller, PLC. Design and mechatronics			
Luaran (Outcomes)	Kemampuan menggambarkan dan menganalisis aliran sinyal pengukuran (instrumentasi) dari mekanik ke elektrik, kemampuan menggambarkan dan menganalisis aliran sinyalm dari elektrik kemekanik melalui actuator. Kemampuan menghubungkan dinamika mekanik dengan dinamika Elektrik, yang dinyatakan dalam bentuk model matematika, model blok, model diagram, model rangkaian			
Matakuliah Terkait	Instrumentasi			
Kegiatan Penunjang	Praktikum			
Pustaka	Karunakaran, Mechatronics, Tata McGraw-Hill			
	Bolton, Mechatronics (electronic systems in mechanical engineering			
	Hibbeler, Engineering Mechanics			
Panduan Penilaian	Ujian tulis, presentasi : Kuis, UTS, UAS			
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pengenalan: kerangka umum dari mekatronika dan sistem kendali;			
2	Mekanika untuk Elektro			
3	Elektrik untuk Mekanik		Mampu menganalisis kerja system sensor tranduser khususnya bentuk elektromekanik	
4	konsep-konsep sensor, tranduser-tranduser,		Mampu menganalisis karakteristik bagian bagian mekatronika	
5	pengukuran-pengukuran; karakterisistik unjuk kerja dari mekatronika;			
6	sensor digital; akusisi data;			
7	aktuator dan penguat daya;			
8	komponen-komponen aktuator: aktuator mekanik, hidrolik, elektrik dan phenumatik;			
9	pemodelan sistim mekatronika: pemodelan diagram blok & pemodelan matematik;			
10	pemodelan sistim mekatronika: pemodelan diagram blok & pemodelan matematik;		Mampu membuat model system mekatronik	
11	pemodelan sistim mekatronika: pemodelan diagram blok & pemodelan matematik;		Mampu menganalisisi system kerja mekanika mekatronik	
12	mekanika tranlasi dan mekanika rotasi;			

| 13 | mekanika tranlasi dan mekanika rotasi; | | Mampu menganalisisi system kerja mekanika mekatronik | |
| 14 | sistem fluida dan sistem termal. | | Mampu membuat algoritma program untuk system mekatronik sederhana | |

Silabus dan Satuan Acara Pengajaran (SAP) EL5003

Kode Matakuliah: EL5003	Bobot sks: 3	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Grafika Komputer & Pemrograman GPU			
	Computer Graphics & GPU Programming			
Silabus Ringkas				
Silabus Lengkap	Tujuan dari kelas ini adalah untuk: • mempelajari konsep-konsep esensial dari grafika computer, seperti: (1) hardware and software components of graphics systems; (2) Output, Data primitives dan rasterisasi; (3) 2D and 3D geometric transformations; (4) Two dimensional viewing: viewing pipeline, clipping, and windowing; (5) Three dimensional viewing: viewing pipeline, viewing parameters, projections, viewing transformations, clipping, visible surface detection; dan (6) illumination models dan surface rendering. • mempelajari bagaimana menulis aplikasi grafika computer dengan bantuan API seperti OpenGL dan DirectX, konsep 3D Engine dan SceneGraph. • mempelajari arsitektur perangkat keras grafika computer modern (seperti GPU – Graphics Processor Unit) dan penggunaannya secara efektif. Selain itu penggunaan GPU pada drive cutting-edge 3D game engines, virtual reality simulations, and film pre-production juga penggunaanya sebagai bagian yang integral dari kekuatan komputasi dari host-nya untuk menyelesaikan problem-problem spesifik seperti newtonian simulation, image processing etc juga akan dibahas.			
Luaran (Outcomes)				
Matakuliah Terkait	Programming		Prasyarat	
	Engineering Math		Prasyarat	
Kegiatan Penunjang				
Pustaka	Francis S. Hill, Jr., "Computer Graphics Using OpenGL", 2nd edition, Prentice Hall, 2000			
	Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis, "OpenGL Architecture Review Board, OpenGL Programming Guide", Fifth Edition: The Official Guide to Learning OpenGL, Addison Wesley			
	Ron Fosner , Real-Time Shader Programming, ISBN:1558608532, Morgan Kaufmann Publishers, 2003			
	Randi J. Rost, OpenGL Shading Language, ISBN:0-321-19789, Addison-Wesley, 2004			
	Wolfgang Engel, ShaderX2 : introductions and tutorials with DirectX 9, ISBN 1-55622-902-X, Wordware Publishing, Inc., Plano Texas, 2004			
	www.gpgpu.org			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			
2	Mathematics review - trigonometry, vectors, matrices			
3	Ray tracing - perspective, viewing, intersections			
4	Ray tracing - shadows and shading, multisampling			
5	Transformations			
6	Viewing			
7	The graphics pipeline - rasterization, clipping, z-buffer, culling - Part 1			
8	The graphics pipeline - rasterization, clipping, z-buffer, culling - Part 2			
9	Surface shading			
10	Texture mapping			
11	Shadows, shadow volumes and shadow maps			
12	Data structures for graphics			
13	Curves and surfaces – Part 1			
14	Curves and surfaces – Part 2			

Silabus dan Satuan Acara Pengajaran (SAP) EL5004

Kode Matakuliah: EL5004	*Bobot sks:* 3	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur
Nama Matakuliah	Sistem Intelijen			
	Intelligent System			
Silabus Ringkas				
Silabus Lengkap	Tujuan dari kelas ini adalah untuk memperkenalkan kepada siswa metoda-metoda penting dan model-model kecerdasan buatan untuk kebutuhan pemodelan sistem-sistem kompleks dan simulasi. Artifisial life dibahas sebagai studi kasus dari penerapan konsep kecerdasan buatan dalam pemodelan behavior sistem. Topik: bio-inspired computing, evolutionary algorithms, genetic algorithms, genetic programming, artificial life, cellular automata, cellular computing, self-replication, artificial neural networks.			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	M. Sipper, Machine Nature: The Coming Age of Bio-Inspired Computing, McGraw-Hill, New York, 2002			
	Tettamanzi & M. Tomassini, Soft Computing: Integrating Evolutionary, Neural, and Fuzzy Systems, Springer-Verlag, Heidelberg, 2001			
	Z. Michalewicz. Genetic Algorithms + Data Structures = Evolution Programs. Springer-Verlag, Berlin, 3rd edition, 1996			
	An Introduction to Genetic Algorithms. MIT Press			
	J. Koza, Genetic Programming: On the Programming of Computers by Means of Natural Selection, MIT Press, Cambridge, MA, 1992			
	M. Sipper. Evolution of Parallel Cellular Machines: The Cellular Programming Approach. Springer-Verlag, Heidelberg, 1997			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			
2	Agents			
3	Search			
4	Informed Search/CSP			
5	Propositional Logic			
6	First Order Logic			
7	Knowledge Representation			
8	Inference in first Order Logic			
9	Prolog, Planning			
10	Neural Networks			
11	Uncertainty			
12	Machine Learning			
13	NLP			
14	Conclusions			

Silabus dan Satuan Acara Pengajaran (SAP) EL5005

Kode Matakuliah: EL5005	Bobot sks: 3	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Desain Interaksi
	Interaction Design

Silabus Ringkas	

Silabus Lengkap	Tujuan dari kelas ini adalah untuk: - Lingkup desain interaksi, definisi & tujuan desain interaksi, hubungan desain interaksi dengan bidang-bidang lain, user experience, usability goals, proses dalam desain interaksi, prinsip desain, usability principles. - Pemahaman & konseptualisasi interaksi, kerangka ruang-masalah dan ruang-desain, model konseptual, metafora dan analogi, metafora interface, paradigma interaksi (instruksi, konversi, manipulasi,eksplorasi), model konseptual ke desain fisik. - Pemahaman terhadapa pengguna (manusia), aspek kognisi utama (atensi, persepsi & memori, dll), teori kognisi (model mental, pemrosesan informasi, kognisi eksternal). - Desain untuk kolaborasi dan komunikasi, mekanisme social dalam kolaborasi & komunikasi, studi etnografi, kerangka konseptual. - Pengaruh interface terhadap pengguna, aspek afektif pengguna, interface ekspresif, mengatasi frustasi pengguna, karakter/agen virtual. - Proses dalam desain interaksi, empat aktifitas dasar, tiga karakteristik dasar, model siklus-hidup suatu desain interaksi. - Identifikasi kebutuhan dan penetapan persyaratan, pengumpulan data, analisa dan interpretasi data, deskripsi tugas dan analisis tugas. - Desain, pembuatan prototip dan konstruksi, definisi dan jenis prototip, desain konseptual, desain fisik. - Desain interaksi dengan pendekatan pengguna, pelibatan pengguna dalam desain, level keterlibatan, partisipatoris desain - Pentingnya evaluasi, kerangka evaluasi, pengamatan terhadap pengguna, bertanya kepada pengguna dan pakar. - Pengujian, paradigma dan teknik pengujan, kerangka petunjuk melakukan evaluasi Pengamatan terhadap pengguna, bertanya kepada pengguna dan pakar (wawancara, kuesioner),pengujian dengan pengguna, pengujian dengan model. - Desain dan evaluasi masalah nyata.

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	J. Preece, Y. Rogers, H. Sharp, Interaction Design, 2002.
	A. Dix, J. Finlay, G. Abowd, R. Beale, Human Computer Interaction, Prentice Hall, 2003.

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	What is Interaction Design			
2	Understanding and Conceptualizing Interaction			
3	Understanding Users			
4	Designing for Collaboration and Communication			
5	Affective Aspects			
6	Interfaces and Interactions			
7	Data Gathering			
8	Data Analysis, Interpretation and Presentation			
9	The Process of Interaction Design			
10	Identifying Needs and Establishing Requirements			
11	Designing and Prototyping			
12	Introducing Evaluation			
13	An Evaluation Framework			
14	Usability Testing and Field Studies			

Silabus dan Satuan Acara Pengajaran (SAP) EL5006

Kode Matakuliah: EL5006	Bobot sks: 3	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Desain Aplikasi Interaktif
	Design Interactive Application
Silabus Ringkas	

Silabus Lengkap	Tujuan dari kelas ini adalah untuk:
	 - mempelajari rekayasa sistem dan aliran kerja dalam proses perancangan dan implementasi aplikasi media digital interaktif.
	 - mempelajari tentang karakteristik dari aplikasi media digital interaktif dari sisi kesejarahannya, game play dan genre tradisional.
	 - mempelajari tentang karakteristik khusus dari aplikasi media digital interaktif modern:
	  o Interaktivitas & Visualisasi
	  o Pemodelan dan Simulasi
	  o Massive Data dan Sistem Cerdas
	  o Social Media & Kolaborasi
	  o Gamification
	 - mempelajari beberapa aspek dasar dari aplikasi media digital interaktif: story, game play, interaction, interface, graphics/sound/music (immersion), level design, packaging (doc, tutorials, cinematic); Types of users
	 - mempelajari aspek-aspek penting dalam aplikasi media digital interaktif: sistem aturan, tantangan dan hadiah, tipe tantangan, flow, keseimbangan
	 - mempelajari peran dari storytelling
	 - mempelajari arti penting dari pengembangan karakter
	 - mempelajari arti penting dari interaktivitas: Interaction techniques; Interaction devices; Interaction tasks
	 - mempelajari arti penting dari Grafika Komputer
	 - mempelajari aspek-aspek dalam motion control
	 - mempelajari aspek-aspek dari perilaku: Scripting; Reactive behavior; Finite state machines; Rule-based approaches; Agents; A-life

Luaran (Outcomes)	
Matakuliah Terkait		
Kegiatan Penunjang	
Pustaka	Andrew Rollings, Ernest Adams, On Game Design, New Riders Publishing, 2003
	Katie Salen, Eric Zimmerman, Rules of Play, Game Design Fundamentals, The MIT Press, 2004
	Andrew Rollings, Dave Morris, Game architecture and design, New Riders Publishing, 2003
	Chris Crawford, On Game Design, New Riders Publishing, 2003
	Jacob Habgood, Mark Overmars, The Game Maker's Apprentice: Game development for beginners, Apress, 2006
	Ernest Adams, Andrew Rollings, Fundementals of Game Design, Pearson Prentice Hall, 2007
	http://www.cs.uu.nl/docs/vakken/gds/
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1				
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Silabus dan Satuan Acara Pengajaran (SAP) EL5007

Kode Matakuliah: EL5007	*Bobot sks:* 3	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Manjemen Keamanan Informasi
	Information Security Management

Silabus Ringkas	To introduce the student to fundamental principles and practices used in the management of Information Security. The course will provide the student with an understanding of the principles of information security management. It will introduce the student to commonly used frameworks and methods and explore critically the suitability and appropriateness of these for addressing today's organisational security needs. The course comprises the following topics: governance and security policy, threat and vulnerability management, incident management, risk management, information leakage, crisis management and business continuity, legal and compliance, security awareness and security implementation considerations.

Silabus Lengkap	**1 – Information Security Governance:** How to Establish and maintain an information security governance framework and supporting processes to ensure that the information security strategy is aligned with organizational goals and objectives, information risk is managed appropriately, and program resources are managed responsibly.
	2 – Information Risk Management and Compliance: How to Manage information risk to an acceptable level to meet the business and compliance requirements of the organization.
	3- Information Security Program Development and Management: How to Establish and manage the information security program in alignment with the information security strategy
	4 – Information Security Incident Management: How to Plan, establish, and manage the capability to detect, investigate, respond to and recover from information security incidents to minimize business impact

Luaran (Outcomes)	1. Describe information security concepts 2. Justify the need for Information Security Management 3. Identify various security management techniques 4. Understand Strategic Security Planning. 5. Understand Risk Assessment and Management 6. Assess Security Management Standards and Practices 7. Understand a Security Architecture 8. Identify Legal, Ethical and Regulatory Issues.

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	CISM® Review Manual 2013
	A Practical Guide to Managing Information Security Steve Purser Artech House, 2004 ISBN 1-58-053702-2
	Fundamentals of Network Security Eric Maiwald McGraw Hill Technology Education, 2004 ISBN 0-07-223093-2

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction:**	Information Security Overview		
2	**Introduction:**	Information Security Management		
3	**Security Management Techniques :**	Vulnerabilities, Threats, Risks		
4	**Security Management Techniques :**	Strategy, Policy, Awareness, Training, Outsourcing		
5	**Risk Assessment :**	Techniques, Methods		

6	**Risk Management:**	Management / Control / Treatment		
7	**Information Security Strategy:**	Need, Planning, Development, Aligning with Business		
8	**Information Security Policy and Standards**	: Policy Development, Policy and Documentation		
9	**Information Security Policy and Standards:**	ISO 27001, NIST, COBIT		
10	**Managing Technology:**	Complexity, Convergence, Rate of Change		
11	**Information Security Architecture :**	Life Cycle Management		
12	**Information Security Audit:**	Rationale, Tools and Techniques		
13	**Managing Security in a Global Environment**			
14	**Legal and Regulatory Issues, Compliance and Ethics**			

Silabus dan Satuan Acara Pengajaran (SAP) EL5090

Kode Matakuliah: EL5090	*Bobot sks:* 3	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Prodi

Nama Matakuliah	Metoda Penelitian
	Research Method

Silabus Ringkas	Framework for designing a research, use of the literature, writing strategy, the introduction to the study, the purpose statement of a study, research question, objectives and hypotheses, the use of theory, definitions-delimitation-significance, qualitative method, quantitative method, mixed method, data collect and analysis, writing an academic publication

Silabus Lengkap	1. Choose a single paradigm of research either qualitative or quantitative, consider the method of data collection and analysis within this paradigm, and identify a methodology or format for the study. 2. Provide a foundation for the entire study plan, how and when to use literature in qualitative and quantitative studies, the purpose of a literature review, discuss about a research literature map for summarizing the literature. 3. Discuss several differences in writing the introduction from a qualitative and quantitative standpoint are proposed, present consisting of issue-problem-literature-audience components. 4. Discuss the importance of the purpose statement, followed by key principles to be included in writing a purpose from a qualitative and quantitative perspective. 5. Explain some terms including research questions, objectives, and hypotheses, the use of theory, definitions-delimitations-significance of the study 6. Comprehend research method including qualitative method, quantitative method, and mixed method, data collect and analysis 7. Understand how to write an academic publication
Luaran (Outcomes)	1. To introduce students to the research prospectus and thesis/dissertation writing process with the focus on both the rhetorical framework and grammatical patterns germane to these tasks and the purpose of the research project. 2. To provide training in regularly occurring rhetorical tasks and patterns associated with writing up research. This course includes but is not limited to: producing literature reviews and/or annotated bibliographies with the concentration on conventions of style and format of specific academic disciplines; synthesizing and relating verbal and nonverbal materials; analyzing research data and drawing conclusions. 3. To provide training for the development of self-editing and proofreading skills. 4. To provide individualized assistance with the drafting phase of documents.
Matakuliah Terkait		
Kegiatan Penunjang	
Pustaka	Creswell, J.W., Research Design Qualitative, Quantitive, and Mixed Methods Approaches, Sage Publications, Second Edition, 2003
	Oates, B.J., Researching Information Systems and Computing, Sage Publication, 2007
	Weissberg, R. and Buker, S., Writing Up Research: Experimental Research Report Writing for Students of English, Prentice-Hall, 1990
	Langan, J., English Skill, Mc-Graw Hill, Third Edition, 1987
	Buku Pedoman Ejaan Bahasa Indonesia
	Buku Panduan Tesis Sekolah Pasca Sarjana – ITB
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	*Introduction*			
2	*A Framework for the Study*			Chapter 1
3	*The Use of the Literature*			Chapter 2
4	*Writing Strategy*			Chapter 3
5	*Introduction to the Study* *The Purpose Statement*			Chapter 4 Chapter 5
6	*Question, Objectives, and Hypotheses*			Chapter 6
7	*The Use of Theory* *Definitions, Delimitations, and Significance*			Chapter 7 Chapter 8

Bidang Akademik dan Kemahasiswaan ITB	**Kur2013-S2-EL**	**Halaman 13 dari 159**

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8	*Midterm Exam Week*			
9	*A Quantitative Method*			Chapter 9
10	*A Qualitative Method*			Chapter 10
11	*A Mixed Method*			Chapter 11
12	*Collect and Analysis Data*			
13	*Writing an Academic Publication*			
14	*Final Project Presentation*			
	Final Project Presentation			

Silabus dan Satuan Acara Pengajaran (SAP) EL5101

Kode Matakuliah: EL5101	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Teori Informasi dan Pengkodean
	Information Theory and Coding

Silabus Ringkas	
	Basic concepts of information theory and Coding Theory

Silabus Lengkap	
	Part 1: Basic concepts of information theory. Entropy. Mutual information. The asymptotic equipartition property. Applications to source coding (data compression). Applications to channel coding (channel capacity). Shannon's noiseless coding theorem and Shannon's fundamental coding theorem. Modeling of information sources: zero-memory and Markov models. Modeling of information channels: Binary Symmetric Channel and its variants. Additivity of information and cascaded channels. Part 2: Coding Theory. Construction of compact source codes: Kraft inequality, compact codes. Huffman codes and universal data compression (Lempel-Ziv) codes. Analysis and design of error-control channel codes: Hamming codes, cyclic codes (CRC and BCH codes). A brief introduction to Reed-Solomon codes. and Turbo codes.

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	Shu Lin, Costello, Jr, Daniel J., "Error Control Coding", Prentice Hall, 2004. (1)
	Jay L. Devore, Probability and Statistics for Engineering and Sciences, 6th Edition (2)
	Cover and Thomas, "Elements of Information Theory", John Wiley and Sons, 1991. (3)

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			(1) (2)
2	Probability and Statistics	Counting Technique, Conditional Probability, Bayes Theorem, Independent Event, Random Variable, Binomial Distribution Probability		(2)
3	Information and Coding Theory	Entropy and Information Rate, Mutual Information,		
4	Information and Coding Theory	Capacity of a Discrete Channel, The Shannon Theorems		
5	Linear Block Codes	Syndrome and Error Detection		(1) Chapter 3
6	Cyclic Block Codes	Generator, encoding		(1) Chapter 4
7	Cyclic Block Codes	Syndrome Computation, Decoding Cyclic codes		(1) Chapter 4
8	Finite Field Arithmetic	Contruction and Basic Properties of Galois Field		(1) Chapter 2
9	BCH and Reed Solomon Codes	Decoding of the BCH Codes, implementation of error correction		(1) Chapter 6
10	BCH and Reed Solomon Codes	Nonbinary BCH codes and Reed-Solomon Codes		(1) Chapter 6
11	Convolutional Codes	Encoding of Convolutional Codes		(1) Chapter 10
12	Convolutional Codes	Structural Properties and distance properties of Convolutional Codes		(1) Chapter 10
13	Viterbi Decoding	The viterbi algorithm		(1) Chapter 11
14	Viterbi Decoding	Implementation of viterbi algorithm		(1) Chapter 11

Silabus dan Satuan Acara Pengajaran (SAP) EL5102

Kode Matakuliah: EL5102	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Arsitektur Komputer Lanjut			
	Advanced Computer Architecture			
Silabus Ringkas				
Silabus Lengkap	Advances in computer architecture concepts and techniques to improve processor performance. Analyze the architectural design of real processors to find out how architectural concepts can be applied. Apply processor architecture concepts to networked based system design. Advances in low power architecture and embedded processor design.			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	Kai Hwang, "Advanced Computer Architecture", Mc Grawhill, 1993. (1)			
	John L. Hennessy, "Computer Architecture: A Quantitative Approach", Third Edition, MKP, 2002 (2)			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			(2)
2	Parallel Computer Models			Chapter 1 (1)
3	Program and Network Properties			Chapter 2 (1)
4	Principles of Scalable Performance			Chapter 3 (1)
5	Processors and Memory Hierarchy			Chapter 4 (1)
6	Bus, Cache, and Shared Memory			Chapter 5 (1)
7	Pipelining and Superscalar Techniques			Chapter 6 (1)
8	Multiprocessors and Multicomputers			Chapter 7 (1)
9	Multivector and SIMD Computers			Chapter 8 (1)
10	Scalable, Multithreaded, and Dataflow Architectures			Chapter 9 (1)
11	Parallel Models, Languages, and Compilers			Chapter 10 (1)
12	Parallel Program Development and Environments			Chapter 11 (1)
13	UNIX, Mach, and OSF/1for Parallel Computers			Chapter 12 (1)
14	Recent Advances in Computer Architecture			(1) 2003 Edition

Silabus dan Satuan Acara Pengajaran (SAP) EL5103

Kode Matakuliah: EL5103	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Jaringan Komputer Lanjut
	Advanced Computer Network

Silabus Ringkas	

Silabus Lengkap	This is a graduate level course on computer networking focusing on advanced topics. We will read research papers on most recent topics of computer networking: This class examines the current and emerging research topics in computer networking. Topics covered include network protocols, network measurement, Internet routing, peer to peer networks, network security, wireless and sensor networks. We focus both on the existing technologies also on why some of them are not sufficient because of technology trends or changes in fundamental assumptions. Emphasis of the course is on topics in wide-area networks and measurement methodologies for Internet experiments. Students are expected to carry out a research project including analysis, design, and implementation components when appropriate on a novel subject.

Luaran (Outcomes)	

Matakuliah Terkait	Computer Network	Prasyarat

Kegiatan Penunjang	

Pustaka	Behrouz Forouzan, "Data Communications and Networking", McGraw-Hill, 2007. (1)
	M. Crovella and B. Krishnamurthy, "Internet Measurement: Infrastructure, Traffic and Applications", 2006
	Kumar, D. Manjunath and J. Kuri, "Communication Networking, An Analytical Approach", 2004

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction, Socket			Chapter 1
2	Network Models, Client – Server Model			Chapter 2
3	Data and Signals, UDP Transfer File			Chapter 3
4	Digital Transmission			Chapter 4
5	Analog Transmission			Chapter 5
6	Bandwidth Utilization: Multiplexing and Spreading			Chapter 6
7	Error Detection and Correction			Chapter 10
8	Data Link Control			Chapter 11
9	Multiple Access, Wired LANs: Ethernet, Wireless LANs			Chapter 12, 13, 14
10	Netvvork Layer: Logical Addressing, Internet Protocol, Address Mapping, Error Reporting, and Multicasting			Chapter 19, 20, 21
11	Network Layer: Delivery, Fonvarding, and Routing			Chapter 22
12	Process-to-Process Delivery: UDp, TCP, and SCTP			Chapter 23
13	Congestion Control and Quality ql'Sen'ice Domain Name System, Remote Logging, Mail, File trans			Chapter 24, 25, 26
14	WWW, HTTP, SNMP			Chapter 27, 28

Silabus dan Satuan Acara Pengajaran (SAP) EL5104

Kode Matakuliah: EL5104	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Nanoelektronika
	Nanoelectronics
Silabus Ringkas	Sejarah dan gambaran umum nanoelektronika, konsep *MOSFET Scaling*, fenomena quantum, pengantar nano aplikasi lain
	History and overview, Concept of MOSFET Scaling, Quantum phenomenons, Introduction to other nano applications
Silabus Lengkap	Sejarah dan gambaran umum, konsep MOSFET Scaling approach, konsep MOSFET Scaling limiting parameter, penomena quantum, pengantar nano applications, Extending MOSFET scaling, Nanofabrication and characterization, Electron Tunneling, Quantum confinement, Ballistic transport, Coulomb blockade and Coulomb oscillation, Carbon Nanotubes, Quantum photonics, Spintronics, Quantum Computing, Quantum Memory, Nano electro mechanical system (NEMS)
	History and overview, Concept of MOSFET Scaling approach,Concept of MOSFET Scaling limiting parameter, Quantum phenomenons, Introduction to other nano applications, Extending MOSFET scaling, Nanofabrication and characterization, Electron Tunneling, Quantum confinement, Ballistic transport, Coulomb blockade and Coulomb oscillation, Carbon Nanotubes, Quantum photonics, Spintronics, Quantum Computing, Quantum Memory, Nano electro mechanical system (NEMS)
Luaran (Outcomes)	Setelah menyelesaikan kuliah ini diharapkan mahasiswa memiliki wawasan tentang masa depan teknologi mikroelektronika terkait scaling devais, penelitian dan pengembangan lanjutan nanoelektronika yang memanfaatkan efek kuantum, dan mengerti konsep-konsep dasar fisika kuantum yang mendasari devais nanoelektronika di masa mendatang
Matakuliah Terkait	EL3042 - Semiconductor Devices Prasyarat
	EL4041- IC Technology Prasyarat
Kegiatan Penunjang	
Pustaka	G. W. Hanson: Fundamentals of Nanoelectronics. Pearson Prentice Hall. 2008 (*Pustaka alternatif*)
	Shunri Oda & David Ferry: Silicon Nanoelectronics. CRC Press. 2006 (*Pustaka alternatif*)
	Marc Baldo: Introduction to nanoelectronics. MIT OpenCourseWare Publication. 2010. (*Pustaka pendukung*)
Panduan Penilaian	Penilaian dari ujian tertulis, tugas presentasi, dan diskusi. Tugas tambahan akan diberikan jika diperlukan.
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to Nanoelectronics: history and overview	•Tube, transistor, and integrated circuits. •Moore law and miniaturization. •Fabrication resolution challenges.	Mahasiswa mampu menjelaskan impact MOSFET skala nm dalam hal fisika dan teknologi fabrikasinya	Hanson, 2008. Ch. 1
2	MOSFET scaling approaches MOSFET scaling limiting parameters (1)	•Constant VDD scaling •Constant field scaling •Quasi constant field scaling •Short channel effects: DIBL, saturated velocity, hot electrons	Mahasiswa mampu menjelaskan kembali berbagai konsep miniaturisasi MOSFET, mampu menghitung parameter miniaturisasi. Mahasiswa mampu menjelaskan efek short channel, sumber-penyebabnya, dan akibatnya bagi performa MOSFET	Oda&Ferry, 2006
3	MOSFET scaling limiting parameters (2)	•Off state current leakage •Performance degradation •Power dissipation issues •Interconnection Issues	Mahasiswa mampu menjelaskan berbagai permasalahan kunci dalam miniaturisasi MOSFET: arus bocor, penurunan performa, isu power dan interkoneksi	Oda&Ferry, 2006
4	Extending MOSFET scaling : key technology of present MOSFET fabrication (1)	•Short review on MOSFET Physics •High-K material for gate dielectric	Menyegarkan pemahaman tentang MOSFET, dan menjelaskan bagaimana pemakaian material high-K untuk miniaturisasi	Oda&Ferry, 2006
5	Extending MOSFET scaling : key technology of present MOSFET fabrication (2)	•SOI technology versus bulk technology •New MOSFET structure	Mahasiswa mampu menjelaskan manfaat SOI untuk miniaturisasi, mampu menjelaskan bentuk-bentuk MOSFET masa depan	Oda&Ferry, 2006
6	Nanofabrication and characterization (1)	•Top down versus bottom up approach •Advanced top-down fabrication technology: electron/ion beam lithography, MBE, nanoimprints	Mahasiswa mampu menjelaskan konsep fabrikasi topdown dan bottom up, bebagai perlengkapan fabrikasi yang advance, dan merancang proses singkat untuk struktur sederhana	Oda&Ferry, 2006
7	Nanofabrication and	•Advanced lithography	Mahasiswa mampu menjelaskan	Oda&Ferry, 2006

		techniques •Nanomaterial synthesis •Nanodevice characterization	metode karakterisasi nanodevais, dan metode advance untuk nano fabrikasi	
8	Electron Tunneling	•Review on band energy concept •Fowler Nordheim tunneling •Direct tunneling •Tunneling probability •Tunneling events in nanoscale MOSFETS •Double barrier and resonant tunneling •Tunneling aplications	Mahasiswa mampu menjelaskan konsep tunneling electron melewatu satu barrier potensial, mampu menghitunh probabilitas tunneling, mampu menjelaskan fenomena tunneling pada MOSFET skala nano.	Hanson, 2008
9	Quantum confinement (1)	•Energy level quantization •Concept of confinement energy •Density of states of confined electron	Mahasiswa mampu menjelaskan konsep kuantisasi energi dan menghitung level kuantisasi, dan efek kuantisasi terhadap Density of States	Hanson, 2008
10	Quantum confinement (2)	•Quantum well, quantum wire, quantum dots •Heterostructure junctions and 2DEG	Mahasiswa mempu menjelaskan tentang 1D, 2D, dan 3D confinement, dan menjelaskan satu aplikasi confinement yaitu heterostructure	Hanson, 2008
11	Ballistic transport	•Difusive transport vs ballistic transport •Experimental ballistic transport •Concept of quantum resistance •Quantum point contact	Mahasiswa mampu menjelaskan tentan konsep difusive dan ballistic transport, kriteria ballistic transpor, konsep quantum resistance, dan aplikasinya pada quantum point contact	Hanson, 2008
12	Coulomb blockade and Coulomb oscillation (1)	•Tunnel junction and coulomb blockade •Quantum dot circuit, coulomb staircase	Mahasiswa mampu menjelaskan karakteristik tunnel juction dan quantum dot, yaitu coulomb blockade dan coulomb staircase	Hanson, 2008
13	Coulomb blockade and Coulomb oscillation (2)	•Single electron transistor, coulomb diamond •SET fabrication and experiments •SET application	Mahasiswa mampu menjelaskan karakteristik Single Electron Transistor dan coulomb blockade, menjelaskan fungsi gate pada pengaturan karakteristik SET	Hanson, 2008
14	Carbon Nanotubes Quantum photonics	•Graphene and carbon nanotube •CNT classification •CNT Electrical characteristics •CNT application •Photo absorption •Photo luminescence •Quantum Lasers	Mahasiswa mampu menjelaskan karakteristik unik carbon nano tube, klasifikasinya, dan aplikasinya di masa depan. Mahasiswa mampu menjelaskan konsep absorbsi dan luminasi photon, prinsip kerja dan aplikasi devais nano photonics	
15	Spintronics Quantum Computing	•Spin magnetization •Giant Magnetoresistance •Spin valve •Spintronics application •Bit and qubit •Quantum algorithms •Quantum gates •Quantum applications	Mahasiswa mampu menjelaskan konsep magnetisasi, AMR, dan GMR, serta aplikasi pada devais spintronics. Mampu menjelaskan perbedaan quantum computing dengan konvesional, konsep quantum bits, gate, dan algoritmanya	
16	Quantum Memory Nano electro mechanical system (NEMS)	•Flash memory •Solid state quantum memory •MEMS review •Nano sensors •NEMS memory	Mampu menjelaskan cara kerja flash memory, dan aplikasi quantum untuk memori. Mahasiswa juga mempu menjelaskan aplikasi nano struktur untuk sensing dan memori.	Oda&Ferry, 2006

Silabus dan Satuan Acara Pengajaran (SAP) EL5105

Kode Matakuliah: EL5105	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	VLSI untuk DSP
	VLSI for Digital Signal Processing

Silabus Ringkas	This course has an objective to provide student with the capabily in designing Application Specific Integrated Circuits (ASICs). In this course, ASICs implementation is more focus on Semicustom Technology using CMOS Standard Cell. The course covers the introduction of various VLSI Technology Implementation and its design flow. The design process includes Architecture Design, Logic Synthesis, Placement and Routing, Design Testing and Verification. The design also involves back annotation and static timing analysis. In order to have complete understanding of design flow, the student will design medium size ASICs as a project

Silabus Lengkap	
	1. Introduction to VLSI Technology 2. Logic Synthesis and Optimization 3. Layout Synthesis and Optimization

Luaran (Outcomes)	Students completing the course should be able to: 1. Having capability of designning medium size of ASIC, starting from Architecture until chip layout 2. Having capability in RTL coding and simmulation 3. Having capability and experiance in using ASICs CAD Tools

Matakuliah Terkait	EL2095 - Sistem Digital	Prasyarat
	EL4045 - Analisis dan Perancangan IC Digital	Prasyarat

Kegiatan Penunjang	

Pustaka	Digital Integrated Circuits (2nd Edition) by Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic
	CMOS VLSI Design: A Circuits and Systems Perspective (3rd Edition) by Neil H.E. Weste and David Harris
	Modern VLSI Design: System-on-Chip Design (3rd Edition) by Wayne Wolf

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to VLSI Technology	What and why VLSI Circuits ?, Moore's Law, Important Issue in VLSI Cost Design, Technology Improvement, State The Art of VLSI Technology Systems-on-a-Chip (SoC), Long-Term Trends		
2	VLSI Technology Implementation	Full Custom and Semi Custom Technology		
3	VLSI Technology Implementation	FPGA cell architecture		
4	ASIC Design Flow	The detail design flow from design entry until chip layout for standard cell based design		
5	ASIC Architecture Design	Mapping from algorithm to signal flow graph, block diagram and timing diagram		
6	RTL Based Design	Verilog Based Combinatorial and Sequential Circuit Design		
7	Design Simmulation & Verification	Functional and Full Timing Simulation, Back Annotation		
8	Logic Synthesis	- Area and Speed Based Synthesis, - Design Constraing, - Bottom Up dan Top Down Synthesis	-	
9	Floorplanning	Cell Placement,		

10	Placement and Routing	- Power Routing, - Detail Routing	-	
11	Static Timing Analysis	System Clock, Critical Path, Set-up Time, Hold Time		
12	Design Rule Check	Technology File, Design Rule Check		
13	Backannotation	Design Parameter Extraction		
14	Design for Test	Boundary Scan, ATPG, Full Scan, Half Scan		
15				

Silabus dan Satuan Acara Pengajaran (SAP) EL5106

Kode Matakuliah: EL5106	*Bobot sks: 2*	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Instrumentasi Cerdas/Lanjut

Silabus Ringkas	Introduction: Intelligence, features characterizing intelligence, intelligent instrumentation system; features of intelligent instrumentation; components of intelligent instrumentation system. Block diagram of an intelligent instrumentation system.

Silabus Lengkap	- Review of Transducers, Principles of operations and its classification, Characteristics, Technological trends in making transducers, Silicon sensors for the measurement of pressure, Level, Flow and Temperature, Bio-sensors ,types and its Application - Radiation Sensors, X -ray and Nuclear radiation sensors, Fiber optic sensors for Temperature, Liquid level, Fluid- flow measurement, Electro-analytical sensors: Electrochemical cell, Standard Hydrogen Electrode (SHE), Smart sensors. - Introduction about Instrumentation systems, Types of Instrumentation systems, Data acquisition system and its uses in intelligent Instrumentation system, Detailed study of each block involved in making of DAS, Signal Conditioners: as DA, IA, Signal Converters (ADC & DAC), Sample and hold, Designing of Pressure, Temperature measuring instrumentation system using DAS, Data logger. - Introduction about Automation system, Concepts of Control Schemes, Types of Controllers, Components involved in implementation of Automation system i.e., DAS, DOS, Converter (I to P) and Actuators: Pneumatic cylinder, Relay, Solenoid (Final Control Element), Computer Supervisory Control System (SCADA), Direct Digital Control's Structure and Software. - Introduction of Programmable logic controller, Principles of operation, Architecture of Programmable controllers, Programming the Programmable controller. - Introduction to Distributed Digital Control, Functional requirements of process control system, System architecture, Distributed Control systems, Configuration, Some popular Distributed Control Systems, Industrial control applications like cement plant, thermal power plant. - Introduction to Intelligent Controllers, Model based controllers, Predictive control, Artificial Intelligent Based Systems, Experts Controller, Fuzzy Logic System and Controller, Artificial Neural Networks, Neuro-Fuzzy Controller system.

Luaran (Outcomes)		
Matakuliah Terkait		
Kegiatan Penunjang	

Pustaka	"Computer-Based Industrial Control", by Krishna Kant, PHI.
	"Process Control Instrumentation Technology", by Curtis D Johnson, Pearson Ed.

Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Module 1	Review of Transducers, Principles of operations and its classification, Characteristics, Technological trends in making transducers, Silicon sensors for the measurement of pressure, Level, Flow and Temperature, Bio-sensors ,types and its Application		
2	Module 1			
3	Module 2	Radiation Sensors, X -ray and Nuclear radiation sensors, Fiber optic sensors for Temperature, Liquid level, Fluid- flow measurement, Electro-analytical sensors: Electrochemical cell, Standard Hydrogen Electrode (SHE), Smart		

		sensors.	
4	Module 2		
5	Module 3	Introduction about Instrumentation systems, Types of Instrumentation systems, Data acquisition system and its uses in intelligent Instrumentation system, Detailed study of each block involved in making of DAS, Signal Conditioners: as DA, IA, Signal Converters (ADC & DAC), Sample and hold, Designing of Pressure, Temperature measuring instrumentation system using DAS, Data logger.	
6	Module 3		
7	Module 4	Introduction about Automation system, Concepts of Control Schemes, Types of Controllers, Components involved in implementation of Automation system i.e., DAS, DOS, Converter (I to P) and Actuators: Pneumatic cylinder, Relay, Solenoid (Final Control Element), Computer Supervisory Control System (SCADA), Direct Digital Control's Structure and Software.	
8	Module 4		
9	Module 5	Introduction of Programmable logic controller, Principles of operation, Architecture of Programmable controllers, Programming the Programmable controller.	
10	Module 5		
11	Module 6	Introduction to Distributed Digital Control, Functional requirements of process control system, System architecture, Distributed Control systems, Configuration, Some popular Distributed Control Systems, Industrial control applications like cement plant, thermal power plant.	
12	Module 6		
13	Module 7	Introduction to Intelligent Controllers, Model based controllers, Predictive control, Artificial Intelligent Based Systems, Experts Controller, Fuzzy Logic System and Controller, Artificial Neural Networks, Neuro-Fuzzy Controller system.	
14	Module 7		

Silabus dan Satuan Acara Pengajaran (SAP) EL5107

Kode Matakuliah: EL5107	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Sistem Kendali Linier
	Linear Control Systems
Silabus Ringkas	
	Introduction to Linear Control Systems ; introduction to optimal control ; dynamic programming; linear quadratic control
Silabus Lengkap	
	Controller design frameworks: control system architecture, controller specifications, controller design methods; analytic tools: norms of signals, norms of systems, geometry of design specifications; design specifications: realizability & closed-loop stability, performance specifications, differential sensitivity specifications, robustness specifications via gain bounds; introduction to optimal control; calculus variables methods; dynamic programming; parameter optimization; linear quadratic control; Linier quadratic regulator; deadbeat regulator
Luaran (Outcomes)	
Matakuliah Terkait	Sistem Kendali Multivariabel / Prasyarat
Kegiatan Penunjang	
Pustaka	*C.L. Phillips and R.D. Harbor, Feedback Control Systems, Fourth Ed. Prentice Hall International, 1996*
	J. E. Gibson, Nonlinear Automatic Control. New York, NY: McGraw-Hill Book Company, 1963
	B.C. Kuo, Automatic Control Theory
Panduan Penilaian	*Exams (85%)* *Homework (15%)*
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	*An introduction to feedback and linear systems*			Phillips & Harbor: 1.1, 1.2
2	*A review of the Laplace transform*			Phillips & Harbor: Appendix B
3	*A (very) brief introduction to MATLAB and SIMULINK*			Kuliah
4	*Block Diagrams, their construction and manipulation*			Phillips & Harbor: 2.3, 5.1
5	*Transfer functions and the behavior of linear systems.*			Phillips & Harbor: 4.1-4.4
6	*Stability and the Hurwitz Array.*			Phillips & Harbor: 6.1, 6.2
7	*The principle of the argument and the Nyquist plot*	*- Minimum phase systems and low pass systems. - The Bode plot and stability.*		Phillips & Harbor: 8.1-8.5
8	*Stability and the root-locus diagram.*			Phillips & Harbor: 7.1-7.5
9	*Lag, lead, and lag-lead compensation.*			Phillips & Harbor: 9.1-9.7
10	*PID compensators.*			Phillips & Harbor: 9.8-9.10
11	*An Introduction to Modern Control Theory.*			Phillips & Harbor: 10.1, 10.2, 10.6

Silabus dan Satuan Acara Pengajaran (SAP) EL5108

Kode Matakuliah: EL5108	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Kendali dan Sistem Cerdas
	Intelligent Systems and Control
Silabus Ringkas	The objective of this course is to learn variety of fuzzy control, and to understand how they employ diversity of heuristic knowledge to achieve control design specifications. Basic concepts and components and their roles in general fuzzy systems are explained to understand how fuzzy controllers work. Nonlinear analysis are used to analyze stability of fuzzy control systems. Based on the idea of fuzzy control, advanced topics in fuzzy control, including fuzzy identification, supervisory fuzzy control, neural networks, genetic algorithm are covered. Matlab is used to illustrate how to program fuzzy control and neural networks in software.
	The objective of this course is to learn variety of fuzzy control, and to understand how they employ diversity of heuristic knowledge to achieve control design specifications. Basic concepts and components and their roles in general fuzzy systems are explained to understand how fuzzy controllers work. Nonlinear analysis are used to analyze stability of fuzzy control systems. Based on the idea of fuzzy control, advanced topics in fuzzy control, including fuzzy identification, supervisory fuzzy control, neural networks, genetic algorithm are covered. Matlab is used to illustrate how to program fuzzy control and neural networks in software.
Silabus Lengkap	Intro to Inteligent Systems and Intelligent Control, Characteristics of Intelligent Systems, Fuzzy Set Theory: basic definition and terminology, membership function(MF), fuzzy set theoritic operations, T-norm, T-conorm, membership function formulation, MF of two dimension, Fuzzy Rules : fuzzy relations, fuzzy relation composition, fuzzy if-then rules, Fuzzy reasoning : compositional rule of inference, fuzzy reasoning, Fuzzy Inference Systems (FIS), Mamdani FIS model, Fuzzy Control : fuzzy control architecture and components, fuzzification, defuzzification, fuzzy rules, fuzzy inference mechanism, fuzzy control structure, fuzzy rules development, fuzzy modeling/identification, fuzzy embedded systems, fuzzy control applications, Biological Neural Networks, Neuron Model and Computation, Artificial Neural Networks (ANN) Topology, Perceptron, Supervised Learning, Perceptron Training, Adaptive Linear Networks, Delta Rule, Multilayer Feedforward Neural Networks (MFNN), MFNN forward computation, MFNN backward computation and Backpropagation, MFNN learning mechanism, ANN application in pattern recognitions and controls, Genetic Algorithm, Matlab implementation
	Intro to Inteligent Systems and Intelligent Control, Characteristics of Intelligent Systems, Fuzzy Set Theory: basic definition and terminology, membership function(MF), fuzzy set theoritic operations, T-norm, T-conorm, membership function formulation, MF of two dimension, Fuzzy Rules : fuzzy relations, fuzzy relation composition, fuzzy if-then rules, Fuzzy reasoning : compositional rule of inference, fuzzy reasoning, Fuzzy Inference Systems (FIS), Mamdani FIS model, Fuzzy Control : fuzzy control architecture and components, fuzzification, defuzzification, fuzzy rules, fuzzy inference mechanism, fuzzy control structure, fuzzy rules development, fuzzy modeling/identification, fuzzy embedded systems, fuzzy control applications, Biological Neural Networks, Neuron Model and Computation, Artificial Neural Networks (ANN) Topology, Perceptron, Supervised Learning, Perceptron Training, Adaptive Linear Networks, Delta Rule, Multilayer Feedforward Neural Networks (MFNN), MFNN forward computation, MFNN backward computation and Backpropagation, MFNN learning mechanism, ANN application in pattern recognitions and controls, Genetic Algorithm, Matlab implementation
Luaran (Outcomes)	After completing this course students should able to : Compare crisp set and fuzzy set, Formulate fuzzy membership function, Understand continuous and discrete fuzzy set, Perform various fuzzy set operations, Compute fuzzy relation composition, Compute membership function of fuzzy rules, Understand fuzzy reasoning, Compute Fuzzy Inference System, Design fuzzy logic control, Determize fuzzy rules in fuzzy control, Understand various fuzzy control schemes, apply fuzzy system in modeling/identification, Program fuzzy concepts in Matlab, Understand neuron model, Compute neuron output given an input signal, perform perceptron training, understand adaptive networks, understand supervised learning, comprehend MFNN, perform MFNN forward computation, perform Backpropagation to update MFNN weights, comprehend fuzzy embedded control, program fuzzy control on microprocessor/microcontroller, understand the use of ANN in pattern recognition and in control, understand Genetic Algorithm, compare model based design with intelligent systems methods, use Fuzzy Logic Toolbox in Matlab, use Neural Networks Toolbox in Matlab, implement fuzzy inference system in embedded microcontroller/microprocessor
Matakuliah Terkait	Sistem Kendali, Sistem Mikroprosesor · Prasyarat
	Sistem Kendali, Sistem Mikroprosesor · Prasyarat
Kegiatan Penunjang	Assignment, programming and experimental project
Pustaka	Neurofuzzy and Soft Computing : A computational Approach to Learning and Machine Intelligence, J.S.R. Jang, C.T. Sun, E. Mizutani, Prentice-Hall, 1997
	Fuzzy Control and Identification, J. Lily, 2010
	Neural Networks : A comprehensive Foundation, S. Haykin, 2002
Panduan Penilaian	Fuzzy Control, Kevin Passino and Stephen Yurkovic, Addison Wesley 1998
Catatan Tambahan	Tugas Ujian Tertulis Projek

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to Intelligent Systems	• Course objective, course syllabus • Intro to intelligent systems • Characteristic of intelligent systems	• Understand basic principles of intelligent system method • Compare model based design and intelligent system method	Nurofuzzy and Soft-computing Fuzzy Control
2	Fuzzy set	• Basic definition and terminology • Membership function • Continuous and Discrete fuzzy set • Fuzzy set examples	• Understand fuzzy set • Characterize fuzzy set using membership function • Provide examples of fuzzy set • Compare crisp and fuzzy sets	Nurofuzzy and Soft-computing
3	Fuzzy set operations MF formulation	• Fuzzy intersection, fuzzy union, fuzzy complement, fuzzy subset • T-norm, T-conorm • MF shape and formulation	• Perform fuzzy set operations • Formulate MF	Neurofuzzy and Soft-computing
4	Matlab programming of fuzzy concepts	• Matlab code of MF • Fuzzy set operation in Matlab	• Program MF in matlab • Program fuzzy set operation in Matlab	Neurofuzzy and Soft-computing
5	Fuzzy Relation and Fuzzy Rules	• Fuzzy relation • Fuzzy composition : max-min composition, max-product composition • Fuzzy rules • Linguistic variables	• Understand fuzzy relation and its MF • Perform fuzzy composition • Determine MF of fuzzy rule • Derived composite linguistic values from primary linguistic values	Neurofuzzy and Soft-computing
6	Fuzzy Reasoning and Its Matlab program Fuzzy Inference System (FIS)	• Fuzzy reasoning • Matlab code for fuzzy relations, fuzzy rule composition • FIS with single antecedent • Mamdani FIS with multiple antecedents	• Understand fuzzy reasoning • Program fuzzy relation, fuzzy rule composition in Matlab • Compute FIS for single and multiple antecedents • Perform graphical representation of FIS with two-inputs and one output	Neurofuzzy and Soft-computing Fuzzy Control
7	Fuzzy Control	• Fuzzy control architecture • Fuzzy control components : fuzzification, defuzzification, fuzzy rules, fuzzy inference	• Comprehend fuzzy control • Compute defuzzification	Neurofuzzy and Soft-computing Fuzzy Control and Identification Fuzzy Control
8	Fuzzy Control Design and Matlab & Fuzzy Modeling	• Fuzzy rules construction • Fuzzy control in Matlab • Fuzzy modeling	• Develop fuzzy rules based on ideal respons • Design fuzzy control using Matlab • Fuzzy modeling	Fuzzy Control and Identification
9	Fuzzy Control Schemes	• Fuzzy control structure • Adaptive fuzzy control	• Understand various fuzzy control structure	Fuzzy Control
10	Fuzzy control design examples and fuzzy embedded control	• Fuzzy control applications • Fuzzy rules examples • Fuzzy embedded processor • Fuzzy programming	• Design fuzzy control • Understand fuzzy embedded processor/controller • Fuzzy programming on microcontroller	Fuzzy Control and Identification Fuzzy control
11	Biological Neural Networks and neuron Model	• Biological neural networks • Neuron model and computation	• Understand basic principles of biological neural networks • Comprehend neuron model • Compute output of nuron model given input signal	Neural Networks : A Comprehensive Foundation
12	ANN learning	• Supervised learning • Perceptron model and perceptron learning algorithm • Adaptive linear networks • Matlab examples	• Understand supervised learning • Train perceptron to form classification • Comprehend adaptive linear networks and its learning algorithm	Neural Networks : A Comprehensive Foundation
13	Feedforward Multilayer Neural Networks and Backpropagation	• MLNN topology • MLNN forward computation • MLNN backward computation • Matlab examples	• Comprehend MLNN • Perform forward computation • Perform back-propagation	Neural Networks : A Comprehensive Foundation
14	ANN training with Backpropagation and Applications in Modeling and Control	• MLNN training • ANN applications in pattern recognition and in control	• Understand ANN training mechanism • Understand ANN applications	Neural Networks : A Comprehensive Foundation
15	Genetic Algorithm	• Genetic Algorithm • Genetic algorithm for Optimization	• Understand Genetic Algorithm	Neurofuzzy and Soft-computing

Silabus dan Satuan Acara Pengajaran (SAP) EL5109

Kode Matakuliah: EL5109	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Pemodelan dan Identifikasi Sistem
	System Modelling & Identification
Silabus Ringkas	1) Pendahuluan.; 2)Sistem Mekanikal; 3)Sistem Elektrikal; 4)Sistem Fluida ; 5)Sistem Termal; 6) Mixed System; 7)Representasi Model dengan BondGraph; 8)aplikasi perangkat lunak untuk Simulasi.; 9) Pengantar Sistem Stokastik; 10)Linear Regression; 11)Identifikasi model time-series ; 12)Identifikasi real-time 13)Validasi Model 14)Sistem Kendali Adaptif
	1) Introduction., 2) Mechanical Systems; 3) Electrical Systems; 4) Fluid Systems; 5) Thermal Systems; 6) Mixed System; 7) Model Representation using BondGraph; 8) Aplication Software for simulation; 9) Introduction to Stochastic systems; 10) Linear Regression; 11) Identification of time-series models; 12) real-time identification 13) Model Validation 14)Adaptive Control System
Silabus Lengkap	1) Pendahuluan : Model White Box/first principle -Black Box: Identifikasi dan Estimasi, Tipe Model : Linier (ARX, ARMAX, Output error, polynomial model) /nonlinilier, parameteric/non parametric, continous/discrete, deterministic/stokastik , Representasi model :Bond Graph (mixed system), State space, FIR, TF, Kesamaan Sistem, Jenis2 Simulasi (HIL, SIL), Simulation Tool : MATLAB, Solid Works, Bondgraph, Validasi Model.; 2)Sistem Mekanikal : komponen dasar Massa, pegas dan peredam, Sistem translasi dan Rotasi., Prinsip D'Alembert, Persamaan Lagrange, studi kasus ; 3)system Elektrikal : Komponen dasar RLC, konsep impedansi, Hukum Kirchoff, Analisis Rangkaian pasif dan active (Op-Amp), studi kasus; 4)Sistem Fluida : Sifat Fluida (Berat jenis, Viskositas, kec. Propagasi, karakteristik Termal), persmaan state cairan (liquid) dan gas, bilangan reynold ; 5)Sistem Termal : komponen dasar konveksi, konduksi, radiasi, kapasitansi termal, analisis system static dan dinamik, studi kasus.; 6) Mixed System : Sistem elektromekanikal, system fluida-mekanikal dan system elektrohidrolik.; 7)Representasi Model dengan BondGraph : Bond dan port, Storage element and causality, Dissipation element, Transducer element (TF/GY), Junction, studi kasus 8)Perangkat lunak aplikasi untuk Simulasi (Tool) MATLAB, SOLIDWORKS dan BONDGRAPHSIM.; 9) Pengantar Sistem Stokastik :random/stochastic variable, Probabilitas, Fungsi kerapatan probabilitas, Mean, variance, covariacce, studi kasus : noise 10)Linear Regression : Least square estimation 11)Identifikasi model time-series : struktur model, maximum likelihood identification, kalman filter 12)Identifikasi real-time : recursive least-square 13)Validasi Model : Prosedur eksperimen, Penentuan orde model, pengujian residu, akurasi model dan parameter 14)Sistem Kendali Adaptif : MRAC dan Self-tuning Control
	1) Introduction: White Box model : first principle-Black Box: Identification and Estimation, Model Type: Linear (ARX, ARMAX, Output error, polynomial model) / nonlinilier, parameteric / non-parametric, continuous / discrete, deterministic / stochastic, Model representation: Bond Graph (mixed system), State space, FIR, TF, System Similarity, Simulation type (HIL, SIL), Simulation Tool: MATLAB, Solid Works, Bondgraph, Model Validation.; 2) Mechanical Systems: basic components :mass, springs and dampers, translation and rotation system., principle of D'Alembert, Lagrange equation, case studies.; 3) Electrical system: The basic components : RLC, the concept of impedance, Kirchoff's Laws, Analysis of passive and active circuit (Op-Amp), case studies.; 4) Fluid System: fluid properties (density, viscosity, Propagation speed, thermal characteristics), liquid and gas state equations, reynold numbers; 5) thermal system: basic components of convection, conduction, radiation, thermal capacitance, the analysis static and dynamic system, case studies.; 6) Mixed System: electromechanical system, fluid-mechanical system and the electrohydraulic system.; 7) Model Representation with BondGraph: Bond and port, storage element and causality, dissipation element, transducer element (TF / GY), Junction, case studies.; 8) Application software for Simulation : MATLAB, SOLIDWORKS and BONDGRAPHSIM.; 9) Introduction to stochastic Systems: random /stochastic variables, probability, probability density function, mean, variance, covariance, case studies: noise.; 10) Linear Regression : least square estimation.; 11) Identification of time-series models: model structure, maximum likelihood identification, Kalman filter 12) real-time identification : recursive least-squares 13)Model Validation : Experimental procedure, model order determination, residual test, model and parameter accuracy.; 14)Adaptive Control System : MRAC and Self Tuning Control
Luaran (Outcomes)	1) Memahami definisi , terminologi dalam pemodelan dan konteks penggunaannya dalam sebuah sistem 2) Memahami karakteristik/sifat dasar dan hukum dari sistem fisis : Mekanikal, elektrikal, fluida dan termal 3) Mampu menurunkan model matematis sistem statik dan dinamik berdasarkan karakteristik dan hukum dalam sistem fisis 4) Mampu menurunkan model Bond graph dari sistem campuran (elektrik, mekanik, fluida dan termal) 5) Mampu menggunakan tool simulasi 6) Memahami definisi , terminologi dalam system stokastik dan konteks penggunaannya dalam sebuah sistem 7) Mampu melakukan proses identifikasi parameter dengan pendekatan Least Square pada sejumlah set pengukuran (off-line) 8) Mampu melakukan proses identifikasi parameter dengan pendekatan recursive Least Square (on-line) 9) Mampu melakukan proses validasi model 10) Memahami proses pemodelan dan identifikasi dalam Sistem Kendali Adaptif
Matakuliah Terkait	Matematika Lanjut	Bersamaan
Kegiatan Penunjang	Praktikum
Pustaka	Robert L.Wood, Kent L. Lawrence. Modeling and Simulation of Dynamic System, Prentice-Hall, 1997 [Pustaka utama 1]
	Rolf Johansson. System Modeling and Identification, Prentice Hal, 1993 [Pustaka utama 2]
	Dean C. Karnopp, Donald L. Margolis, Ronald C. Rosenberg, System Dynamics : Modeling and Simulation of Mechatronic System. John Willey and Sons, 2005 [Pustaka Pendukung]
Panduan Penilaian	UTS, UAS, Tugas-tugas Pemodelan dan Simulasi system fisis, Experimen Identifikasi
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction:	White Box model : first principle‑Black Box: Identification and Estimation, Model Type: Linear (ARX, ARMAX, Output error, polynomial model) / nonlinilier, parameteric / non-parametric, continuous / discrete, deterministic / stochastic,	1) Memahami definisi , terminologi dalam pemodelan dan konteks penggunaannya dalam sebuah sistem 2) Memahami hukum konservasi energi yang digunakan dalam sistem fisis	Bab 1-2 : Pustaka Utama 1 Bab 1- 2 : Pustaka utama 2 Bab -1 : Pustaka Pendukung
2	Introduction:	Model representation: Bond Graph (mixed system), State space, FIR, TF, System Similarity, Simulation type (HIL, SIL), Simulation Tool: MATLAB, Solid Works, Bondgraph, Model Validation.;	1) Memahami berbagai representasi model 2) Memahami konsep kesamaan sistem 3) Memahami berbagai perangkat lunak simulasi dan konteks penggunaannya	Bab 1-2 : Pustaka Utama 1 Bab 1- 2 : Pustaka utama 2 Bab -1 : Pustaka Pendukung
3	Mechanical Systems	basic components :mass, springs and dampers, translation and rotation system., principle of D'Alembert, Lagrange equation, case studies.;	1) Memahami karakteristik/sifat dasar dan hukum dari sistem Mekanikal, 2) Mampu menurunkan model matematis sistem statik dan dinamik berdasarkan karakteristik dan hukum dalam sistem mekanikal	Bab 3 : Pustaka Utama 1 Bab 7 : Pustaka utama 2 Bab 4 : Pustaka Pendukung
4	Electrical system	The basic components : RLC, the concept of impedance, Kirchoff's Laws, Analysis of passive and active circuit (Op‑Amp), case studies.;	1) Memahami karakteristik/sifat dasar dan hukum dari sistem elektrikal, 2) Mampu menurunkan model matematis sistem statik dan dinamik berdasarkan karakteristik dan hukum dalam sistem elektrikal	Bab 4 : Pustaka Utama 1 Bab 7 : Pustaka utama 2 Bab 4 : Pustaka Pendukung
5	Fluid System	fluid properties (density, viscosity, Propagation speed, thermal characteristics), liquid and gas state equations, reynold numbers	1) Memahami karakteristik/sifat dasar dan hukum dari sistem fluida, 2) Mampu menurunkan model matematis sistem statik dan dinamik berdasarkan karakteristik dan hukum dalam sistem fluida	Bab 5 : Pustaka Utama 1 Bab 4 : Pustaka Pendukung
6	Thermal system:	basic components of convection, conduction, radiation, thermal capacitance, the analysis static and dynamic system, case studies.;	1) Memahami karakteristik/sifat dasar dan hukum dari sistem termal, 2) Mampu menurunkan model matematis sistem statik dan dinamik berdasarkan karakteristik dan hukum dalam sistem termal	Bab 6 : Pustaka Utama 1 Bab 7 : Pustaka utama 2 Bab 4,12 : Pustaka Pendukung
7	Mixed System:	The electromechanical system, fluid‑mechanical system and the electrohydraulic system.	Mampu menurunkan model matematis sistem statik dan dinamik sistem campuran	Bab 7 : Pustaka Utama 1
8	Model Representation with BondGraph	: Bond and port, storage element and causality, dissipation element, transducer element (TF / GY), Junction, case studies.;	1) Memahami definisi , terminologi dalam pemodelan blok dengan Bond Graph dan konteks penggunaannya dalam sebuah sistem 2) Mampu menurunkan model Bond graph sistem campuran	Bab 2,3,7,8 : Pustaka Pendukung
9	Application software for Simulation	MATLAB, SOLIDWORKS and BONDGRAPHSIM.;	Mampu mengoperasikan tool simulasi dan memahami konteks penggunaannya dalam sebuah sistem	Buku Petunjuk Penggunaan
10	Introduction to stochastic Systems	random /stochastic variables, probability, probability density function, mean, variance, covariance, case studies: noise.;	1) Memahami definisi , terminologi dan konteks penggunaannya dalam sebuah sistem stokastik 2) Mampu menghitung besaran stokastik dalam sebuah studi kasus	Appenix D : Pustaka utama 2
11	Linear Regression	least square method, case studies	Mampu melakukan proses identifikasi dengan metode Least Square pada sejumlah set pengukuran (off-line)	Bab 5: Pustaka utama 2
12	Identification of time-series models	model structure, maximum likelihood identification, Kalman filter	Memahami proses identifikasi pada sistem yang dimodelkan secara time-series	Bab 6: Pustaka utama 2
13	real-time identification	recursive least-squares	Mampu melakukan proses identifikasi parameter dengan pendekatan recursive Least Square (on-line)	Bab 11: Pustaka utama 2

14	Model Validation	Experimental procedures, Model order determination, residual test, model and parameter accuracy	Mampu melakukan proses validasi model	Bab 9: Pustaka utama 2
15	Adaptive Control System	Model Reference Adaptive control and Self Tuning Control	Memahami proses pemodelan dan identifikasi dalam Sistem Kendali Adaptif	Bab 15: Pustaka utama 2

Silabus dan Satuan Acara Pengajaran (SAP) EL5110

Kode Matakuliah: EL5110	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Teknologi Sensor dan Aktuator
	Sensor and Actuator Technology

Silabus Ringkas	1)Karakteristik Pengukuran.; 2) Sensor dan Pengkondisi Sinyal untuk Pengukuran Variabel Spasial.; 3)Sensor dan Pengkondisi sinyal untuk pengukuran variable waktu dan frekuensi.; 4)Sensor dan Pengkondisi sinyal untuk pengukuran variable mekanik-Padat.; 5) Sensor dan Pengkondisi sinyal untuk pengukuran variable mekanik-Fluida.; 6) Sensor dan Pengkondisi sinyal untuk pengukuran variable Thermal.; 7) Sensor dan Pengkondisi sinyal untuk pengukuran variable kimia.; 8)kalibrasi Sistem Sensor 9)Aktuator Pneumatic.; 10)Aktuator Hidrolik.; 11)Aktuator Electric dan drive
	1) Measurement Characteristics.; 2) Sensors and Signal Conditioning for Spatial Variables Measurement.; 3) Sensor and Signal Conditioning for time and frequency variable measurement.; 4) Sensor and signal Conditioning for mechanic-solid variable measurement.; 5) Sensor and Signal Conditioning for mechanic-fluid variable measurement.; 6) Sensor and signal Conditioning for thermal variable measurement.; 7) sensor and signal conditioning for chemical variable measurement.; 8) Sensor system calibration.; 9) Sensor Networks 10)Pneumatic Actuators.; 11) Hydraulic actuators.; 12) Electric Actuator and drive

Silabus Lengkap	1)Karakteristik Pengukuran : Karakteristik Instrumen, Mode Operasi Instrumen, Karakterstik Statik dan Dinamik Instrumen , kinerja pengukuran : keterulangan, akurasi, presisi dan resolusi, standar2 pengukuran.; 2) Sensor dan Pengkondisi Sinyal untuk Pengukuran Variabel Spasial : Displacement (linier/sudut), proximity, jarak, ketebalan, area, volume, kecepatan. Percepatan, vibrasi, kejutan.; 3)Sensor dan Pengkondisi sinyal untuk pengukuran variable waktu dan frekuensi.; 4)Sensor dan Pengkondisi sinyal untuk pengukuran variable mekanik-Padat : massa dan berat, berat jenis, regangan/tarikan. gaya, torsi,.; 5) Sensor dan Pengkondisi sinyal untuk pengukuran variable mekanik-Fluida : Tekanan dan suara, akustik, aliran, viskositas .; 6) Sensor dan Pengkondisi sinyal untuk pengukuran variable Thermal : Suhu, konduksi. Calorymetry, radiasi, spectrum 7) Sensor dan Pengkondisi sinyal untuk pengukuran variable kimia : Ph, kelembaban, komposisi, pengukuran lingkungan 8)kalibrasi SIstem Sensor.; 9) Jaringan Sensor.; 10)Karakteristik Aktuator.; 11)Aktuator Pneumatic,electric-pneumatic.; 12) Aktuator Hidrolik, electric-hydraulic.; 13)Actuator Electric dan drive : stepper, DC, BLDC, Induksi, PMSM 14)Muscular actuator
	1) Measurement Characteristics : Characteristics of Instrumentation : repeatability, accuracy, precision and resolution, Operational Mode of Instrumentation, Static and Dynamic characteristics of Instrumentation, measurement standards.; 2) Sensors and Signal Conditioning for Spatial Variables Measurement: Displacement (linear / angle), proximity, distance, thickness, area, volume, speed. Acceleration, vibration, shock.; 3) Sensor and Signa Conditioning signal for time and frequency variable measurements.; 4) Sensors and Signal Conditioning signals for mechanics-solid variable measurements : mass and weight, density, strain /stress, force, torque,.; 5) Sensor and Signal Conditioning for mechanical-fluid variable measurement: Pressure and sound, acoustics, flow, viscosity.; 6) Sensor and Signal Conditioning for Thermal variables measurement : temperature, conduction. Calorymetry, radiation, spectrum 7) Sensor and Signal Conditioning for chemical variables measurement : pH, moisture, composition, environmental measurements 8) Sensor system calibration; 9) Sensor Networks 10) Actuator Characteristics
	11)Pneumatic Actuator : electro-pneumatic.; 12) Hydraulic actuators : electro-hydraulic. ; 13) Electric Actuator and drive: stepper, DC, BLDC, induction, PMSM

Luaran (Outcomes)	1) Memahami karaketristik pengukuran dan standard pengukuran 2) Memahami Prinsip kerja berbagai sensor untuk system mekanik, fluida, thermal dan proses kimia, robot 3) Mampu mendesain dan mengimplementasi pengkondisi sinyal pada beberapa jenis sensor untuk aplikasi tertentu 4) Memahami prinsip, metoda dan kendala dalam jaringan sensor 5) Memahami karakteristik berbagai aktuator untuk keperluan sebuah aplikasi 6) Memahami metoda dan jenis penggerak yang diperlukan untuk motor elektrik

Matakuliah Terkait	.	.
Kegiatan Penunjang	Praktikum	

Pustaka	John G. Webster, The Measurement, Instrumentation and Sensors Handbook, CRC Press, 1999 [Pustaka utama 1]
	Jacob Fraden, Sensor Handbook : Physics, Design and applications, Springer, 2010 [Pustaka Utama 2]
	Andrew Parr, Hydraulic And Pneumatic System 3rd edition, Elsevier, 2011 [Pustaka Utama 3]
	Austin Hughes, Electric Motor and Drives : Fundamentals, Types and Applications 3rd edition, Elsevier, 2006 [Pustaka Utama 4]
	Andrzej M. Palwak., Sensors and actuators for mechatronics : Design and applications, CRC Press, 2006 [Pustaka Pendukung 1]
	Holger Carl. Protocol and architecture for Sensor Networks John Wiley and Sons, 2007 [Pustaka Pendukung 2]

Panduan Penilaian	UTS, UAS, Tugas Desain, Eksperimen, Demonstration
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Measurement Characteristics	Characteristics of Instrumentation : repeatability, accuracy, precision and resolution,,	1)Memahami karakteristik pengukuran dan standard pengukuran variable fisis	Section I : Bab 1-5 [pust.utama 1] Bab 1- 2 : [pust.utama 2]

		Operational Mode of Instrumentation, Static and Dynamic characteristics of Instrumentation, measurement standards.		
2	Sensors and Signal Conditioning for Spatial Variables Measurement:	Displacement (linear / angle), proximity, distance, thickness, area, volume, speed. Acceleration, vibration, shock.;	1) Memahami Prinsip kerja berbagai sensor untuk pengukuran variable spasial 3) Mampu mendesain dan mengimplementasi pengkondisi sinyal pada beberapa jenis sensor variable spasial	Section II:Bab 6-17 [pust. utama 1] Bab 5,7 [pust. Utama 2]
3	Sensor and Signal Conditioning signal for time and frequency variable measurements	Sensor and Signa Conditioning signal for time and frequency variable measurements	1) Memahami Prinsip kerja berbagai sensor untuk pengukuran variable waktu atau frekuensi (pulsa) 2) Mampu mendesain dan mengimplementasi pengkondisi sinyal pada beberapa jenis sensor variable waktu dan frekuensi	Section III:Bab 18-19 [pust. utama 1] Bab 5 [pust. Utama 2]
4	Sensors and Signal Conditioning signals for mechanics-solid variable measurements :	mass and weight, density, strain /stress, force, torque,.;	1) Memahami Prinsip kerja berbagai sensor untuk pengukuran variable mekanik-padat 2) Mampu mendesain dan mengimplementasi pengkondisi sinyal pada beberapa jenis sensor variable mekanik-padat	Section IV:Bab 20-25 [pust. utama 1] Bab 5,9 [pust. Utama 2]
5	Sensor and Signal Conditioning for mechanical-fluid variable measurement:	Pressure and sound, acoustics, flow, level, viscosity.	1) Memahami Prinsip kerja berbagai sensor untuk pengukuran variable mekanik-fluida (liquid dan gas) 2) Mampu mendesain dan mengimplementasi pengkondisi sinyal pada beberapa jenis sensor variable mekanik-fluida	Section V:Bab 26-31 [pust. utama 1] Bab 5,10,11,12 [pust. Utama 2]
6	Sensor and Signal Conditioning for Thermal variables measurement :	temperature, conduction. Calorymetry, radiation, optical spectrum	1) Memahami Prinsip kerja berbagai sensor untuk pengukuran variable panas 2) Mampu mendesain dan mengimplementasi pengkondisi sinyal pada beberapa jenis sensor variable panas	Section VI:Bab32-36 [pust. utama 1] Bab ,16 [pust. Utama 2]
7	Sensor and Signal Conditioning for chemical variables measurement :	pH, moisture, composition, environmental measurements	1) Memahami Prinsip kerja berbagai sensor untuk pengukuran variable kimia 2) Mampu mendesain dan mengimplementasi pengkondisi sinyal pada beberapa jenis sensor variable kimia	Section X:Bab 70-73 [pust. utama 1] Bab ,13,17 [pust. Utama 2]
8	Sensor system calibration	Sensor system calibration	1)Memahami prosedur dasar melakukan kalibrasi untuk mengukur sebuah variabel 2) Mampu melakukan prosedur kalibrasi pada satu jenis sensor	Bab 1,2, : Pust. Pendukung 1
9	Computer-based Data Acquisition System	Architecture and configuration, system protocol, SCADA, case studies	Memahami arsitektur dan konfigurasi system scada	Bab 8 : Pust. Pendukung 2
10	Sensors Network	Sensors Network	Memahami arsitektur, konfigurasi terminology dan protokol dalam jaringan sensor	Bab 1,2,3,4 : Pust. Pendukung 2
11	Actuator Characteristic	Torque/force density, speed, control type, constraint, Power Calculation	1) Memahami karakteristik dasar berbagai jenis actuator dan kontek aplikasinya 2) Mamapu melakukan perhitungan daya dari system actuator	Bab 1 : Pust. Utama 3
12	Pneumatic Actuators	electro-pneumatic	Memahami prinsip kerja, komponen actuator dan kontek aplikasinya	Bab 3,4,6,7 : Pust. Utama 3
13	Hydraulic actuators	electro-hydraulic	Memahami prinsip kerja, komponen actuator dan kontek aplikasinya	Bab 2,6 : Pust. Utama 3
14	Electric Actuator and drive	Stepper motor, DC motor, BLDC motor	1) Memahami prinsip kerja, komponen actuator dan kontek aplikasinya 2)mampu mendesain dan implementasi system penggerak motor DC/Stepper	Bab 1,2,3,6,11 : Pust. Utama 4
15	Electric Actuator and drive	Induction motor, PMSM	Memahami prinsip kerja, komponen actuator dan kontek aplikasinya	Bab 4,5,6,7,8,9,10,11 : Pust. Utama 4

Silabus dan Satuan Acara Pengajaran (SAP) EL5111

Kode Matakuliah: EL5111	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Kriptografi dan penerapannya
	Cryptography and its application
Silabus Ringkas	The aim of this course is to introduce students to concepts of cryptography and its applications. Cryptography is the fundamental building block of any computer security solution. The knowledge gained from this course will enable students to apply these cryptographic algorithms in a better way to design security solutions
Silabus Lengkap	**Introduction:** Definition, applications, encryption/decryption, history, classical and modern cryptography. **Cryptographic services:** User and data authentication, data integrity, data origin authentication, non-repudiation of origin, data confidentiality. **Cryptographic ciphers:** symmetric and asymmetric ciphers. **Authentication and integrity algorithms:** One-way hash functions, digital signatures. **Protocols:** User authentication and key management protocols. **Public Key Infrastructures:** Certificates, certification processes, revocation, certificate authority interworking, PKI models. **Information Hiding:** steganography, watermarking
Luaran (Outcomes)	By completing this course, the student should be able to: **1.** Describe the various cryptographic algorithms and protocols. **2.** Justify the critical need for strong cryptographic algorithms. **3.** Understand different cryptographic algorithms. **4.** Identify the differences between the various data protection mechanisms. **5.** Describe common data protection approaches and identify their major fields of applications.
Matakuliah Terkait		
Kegiatan Penunjang	
Pustaka	[1] *Handbook of Applied Cryptography* Alfred J. Menezes, Paul C. van Oorschot, Scott A. Vanstone CRC Press LLC, 1997 ISBN 0-8493-8523-7
	[2] *Cryptography: A very Short Introduction* Fred Piper & Sean Murphy Oxford University Press, 2002 ISBN 0-19-280315-8
	[3] *Cryptography and Network Security: Principles and Practice* William Stallings, Prentice Hall, 4th edition, 2006. ISBN 0-13-187316-4
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction:**	Definition, applications, encryption/decryption, history, classical and modern cryptography, One Time Pad		[1], [2], [3]
2	**Introduction:**	Cryptanalysis of classical ciphers.		[1], [2], [3]
3	**Stream Ciphers:**	Enigma, Stream cipher design, LFSR, Correlation, pseudo-random number generators.		[1], [2], [3]
4	**Symmetric ciphers:**	Block ciphers, DES, cryptanalysis of block ciphers.		[1], [2], [3]
5	**Symmetric ciphers:**	Triple DES, block cipher modes of operation, Rijndael and the AES selection process.		[1], [2], [3]

6	**Asymmetric ciphers:**	Principles of public key cryptography, RSA.		[1], [2], [3]
7	**Asymmetric ciphers:**	Attacks on RSA, padding**.**		[1], [2], [3]
8	**Asymmetric ciphers:**	El Gamal, Elliptic Curve Cryptography.		[1], [2], [3]
9	**Authentication and integrity algorithms:**	One-way hash functions. Digital signatures.		[1], [2], [3]
10	**Public Key Infrastructures:**	Certificates, certification processes, revocation, Certificate authority interworking, PKI models, alternative approaches.		[1], [2], [3]
11	**Symmetric ciphers versus asymmetric ciphers:**	security, complexity, applications.		[1], [2], [3]
12	**Protocols:**	Diffie Hellman, User authentication protocols, Key management principles and protocols.		[1], [2]
13	**Protocols:**	Group Communications, Revocation Schemes, Logical Key Hierarchy, Secret Sharing.		[1], [2]
14	**Information Hiding:**	Steganography, Watermarking.		[1], [2]

Silabus dan Satuan Acara Pengajaran (SAP) EL5112

Kode Matakuliah: EL5112	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Keamanan Komputer dan Jaringan
	Computer and Network Security

Silabus Ringkas	This course provides a principled introduction to techniques for defending against hostile adversaries in modern computer systems and computer networks. Topics covered include operating system security; network security, including cryptography and cryptographic protocols, firewalls and network denial-of-service attacks and defenses; user authentication technologies; security for network servers; web security; and security for mobile code technologies. More advanced topics will additionally be covered as time permits, such as: intrusion detection; techniques to provide privacy in Internet applications; and protecting digital content (music, video, software) from unintended use.

Silabus Lengkap	**Foundations of Computer Security:** a comprehensive introduction to computer systems, principles of computer security. **Identification and Authentication:** usernames and passwords, two-factor authentication, single sign-on, alternative approaches. **Access Control:** authentication and authorization, access operations, access control structures.. **Malicious Code:** Trojan horses, viruses, worms, other malicious logics. **Modern Computer Attacks:** Buffer overflow, XSS, SQL injection. **Foundations of Network Security:** a comprehensive introduction to networking and network security. **Network-Based Threats and Attacks:** overview of network-based attacks. **Network Security Protocols:** Authentication protocols, Kerberos. **Network Security Protocols:** SSL/TLS, IPSec, VPN.**Firewalls:** Firewall concepts, Types of Firewalls, Firewall Functions. **Intrusion and Prevention Detection Systems.**

Luaran (Outcomes)	1. Identify common computer and network security vulnerabilities. 2. Assess various identification and authentication techniques. 3. Compare different access control mechanisms 4. Understand concepts of secure network and computer systems. 5. Analyze security of a Network protocol and its implementation

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	[1] *Computer Security* Dieter Gollmann John Wiley & Sons Ltd, 2nd Edition, 2006 ISBN 0-470-86293-9
	[2] *Network Security Essentials* W. Stallings. Prentice-Hall, 2003 ISBN 0-13-120271-5
	[3] *Cryptography and Network Security: Principles and Practice* William Stallings, 2010 Prentice Hall, 5th edition, ISBN 978-0136097044

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Foundations of Computer Security**: computer systems.	a comprehensive introduction to		[1], [2], [3]
2	**Foundations of Computer Security:**	principles of computer security.		[1], [2], [3]
3	**Identification and Authentication:**	usernames and passwords, multi-factor authentication, biometrics		[1], [2], [3]
4	**Access Control:**	authentication and authorization, access operations, access control structures.		[1], [2], [3]
5	**Access Control:**	Bell-La Padula, Biba, RBAC.		[1], [2], [3]

6	**Modern Computer Attacks:**	Buffer overflow, XSS, SQL injection.		[1], [2], [3]
7	**Malicious Code:**	Trojan horses, viruses, worms, Rootkits, malicious code detection techniques.		[1], [2], [3]
8	**Foundations of Network Security**:	a comprehensive introduction to networking		[1], [2], [3]
9	**Foundations of Network Security**:	principles of network security		[1], [2], [3]
10	**Network-Based Threats and Attacks:**	overview of network-based attacks, Botnets, DDoS		[1], [2], [3]
11	**Network Security Protocols:**	Authentication protocols, Kerberos.		[1], [2], [3]
12	**Network Security Protocols:**	SSL/TLS, IPSec, VPN.		[1], [2], [3]
13	**Firewalls:**	Firewall concepts, Types of Firewalls, Firewall Functions.		[1], [2], [3]
14	**Intrusion Detection and Prevention Systems:**	HIDS and NIDS.		[1], [2], [3]

Silabus dan Satuan Acara Pengajaran (SAP) EL5113

Kode Matakuliah: EL5113	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Praktek Legal dan Etis dalam Keamanan Informasi			
	Legal and Ethical Practices in Information Security			
Silabus Ringkas	This course is intended for managers and practitioners of computer science, and is designed to create awareness of the ethical issues, legal resources and recourses, and policy implications inherent in our evolving on-line society. The course provides an overview of the ethical challenges faced by individuals and organizations in the information age and introduces the complex and dynamic state of law as it applies to behavior in cyberspace. It is intended to sensitize managers and computer professionals to the pitfalls and dangers of doing business in an interconnected world, and to familiarize the student with various organizations and materials that can be turned to for assistance in understanding how to ethically and legally operate and use modern computer systems and networks.			
Silabus Lengkap	Legal, Regulation s, Investigations and Compliance – addresses computer crime laws and regulations; the investigative measures and techniques which can be used to determine if a crime has been committed and methods to gather evidence. • Legal issues • Investigations • Forensic procedures • Compliance requirements/procedures			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	[1] LandMark Publications, Cyber Law: Software and Computer Networks (Litigator Series), 2013			
	[2] Michael N. Schmitt, Tallinn Manual on the International Law Applicable to Cyber Warfare, Cambridge University Press, 2013			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to Cyberlaw			
2	Debate over rights to control temporary copying and digital transmissions of copyrighted works and standards for liability of online service providers as a matter of U.S. and international law			
3	WIPO Copyright Treaty Obligations as regards rights management information and regulation of "black-box" technologies			
4	Proposals for a new form of legal protection for the contents of databases			
5	Of shrink-wrap licenses, online contracts, proposed Article 2B of the Uniform Commercial Code, and intellectual property policy			
6	Commerce infrastructure issues			
7	Trademark issues in Cyberspace			
8	Online service liability issues			

9	Gary Reback on cyberspace antitrust issues			
10	Communications Decency Act issues			
11	Export control/cryptography issues			
12	Privacy issues			
13	Additional copyright issues (linking, etc.)			
14	Jurisdiction/conflicts/dispute resolution issues			
15	MUDs/MOOs, Jake Baker, & hackers (crimes of information?)			

Silabus dan Satuan Acara Pengajaran (SAP) EL5114

Kode Matakuliah: EL5114	Bobot sks: 3	Semester: Ganjil	KK / Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Teknik Biomedika dan Praktikum
	Biomedical Engineering and Lab. Works
Silabus Ringkas	Pendahuluan. Dasar-dasar Teknik Biomedika. Dasar-dasar Sistem/Instrumentasi Biomedika. Dasar-dasar potensial bio-listrik. Berbagai jenis transducer & sensor biomedika, penguat operasional & penguat biomedika. Masalah keamanan (safety) pasien. Pengenalan anatomi & fisiologi. Topik-topik khusus. Perkembangan baru dalam Teknik Biomedika & Kuliah penutup.
	Introduction. Fundamentals of Biomedical Engineering. Fundamentals of Biomedical System/Instrumentation. Fundamentals of bioelectric. Various biomedical transducer and sensors. Operational amplifier & biomedical amplifier. Patient safety. Introduction to anatomy and physiology.
Silabus Lengkap	Pendahuluan: penjelasan umum matakuliah, tujuan kuliah, topik-topik bahasan, rencana kegiatan, Evaluasi. Dasar-dasar Teknik Biomedika: pengertian Teknik Biomedika, sifat multi-disiplin, prosedur kedokteran (medical procedure), informasi kedokteran (medical information), masalah keamanan (safety), ruang lingkup; pengenalan anatomi & fisiologi, dasar istilah kedokteran. Dasar-dasar Sistem/Instrumentasi Biomedika: diagram blok, bagian-bagian & fungsinya, cara kerja sederhana, contoh-contoh alat bantu diagnosa & terapi sederhana; diagram rangkaian dan perhitungan soal sederhana. Dasar-dasar potensial bio-listrik: prinsip, contoh-contoh, karakteristik dan cara pengukurannya. Berbagai jenis transducer & sensor biomedika, penguat operasional & penguat biomedika. Masalah keamanan (safety) pasien, kejut listrik macroschock & microshock; beberapa alat pengaman dan program keamanan. Pengenalan anatomi & fisiologi, manfaat. Topik-topik khusus: Telemedika, Biomekanika & Teknik Rehabilitasi, Biomaterials & Tissue Engineering, Gelombang Elektromagnetik & ultrasonik. Perkembangan baru dalam Teknik Biomedika & Kuliah penutup: Contoh topik-topik penelitian & tugas akhir; Ringkasan kuliah.
	Introduction: overview, course objective, course topics, schedule, evaluation and assessment. Fundamentals of biomedical engineering: definition, multidisciplinary fields, medical procedure, medical information, safety, scope of biomedical engineering, medical therminology. Fundamentals of biomedical system/instrumentation: block diagram, it's part and their function, principles, examples (diagnose and therapeutic device). Fundamentals of bioelectric: principles, examples, charactheristics and it's measurement. Variuos biomedical transducer and sensors, operational amplifier and biomedical amplifier. Patient safety, electric shock: macroshock and microshock, hospital equipment safety. Introduction to anatomy and physiology. Special topics in biomedical engineering: telemedicine, biomechanics and rehabilitation engineering, biomaterials and tissue engineering. Ultrasonic and electromagnetic in biomedical engineering. Trends in biomedical engineering. Course review.
Luaran (Outcomes)	1. Memahami pengertian ruang lingkup teknik biomedika, 2. Memahami secara teori dan mengimplementasikan subbidang teknik biomedika, 3. Mampu menganalisis masalah di bidang medis & biologi dan merancang solusinya, 4. Mampu mengidentifikasi implementasi terkini di bidang teknik biomedika.

Matakuliah Terkait	Instrumentasi	Prasyarat
	Anatomi dan Fisiologi	bersamaan

Kegiatan Penunjang	Praktikum, kerja lapangan
Pustaka	1. Joseph D. Bronzino, The Biomedical Engineering HandBook 2nd Edition, CRC Press LLC, 2000 (Pustaka utama)
	2. John G. Webster. Medical Instrumentation: Application and Design, 4th Ed. John Wiley & Sons. 2010 (Pustaka alternatif)
	3. Richard Aston, Principles of Biomedical Instrumentation and Measurement, Merril Publishing Company, 1990 (Pustaka pendukung) 4. Kramme, Rüdiger; Hoffmann, Klaus-Peter; Pozos, Robert Steven. Springer Handbook of Medical Technology. Springer. 2011.
Panduan Penilaian	Praktikum 20%, Tugas 20 %, UTS 30%, UAS 30 %
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pendahuluan	penjelasan umum matakuliah, tujuan kuliah, topik-topik bahasan, rencana kegiatan, Evaluasi	Mahasiswa memahami aturan perkuliahan: jadwal kuliah, ruang lingkup, danskema penilaian	Bab 1 [1], Bab 1 [2], Bab 1 [3]
2	Dasar-dasar Teknik Biomedika.	pengertian Teknik Biomedika, sifat multi-disiplin, prosedur kedokteran (medical procedure), informasi kedokteran (medical information), masalah keamanan (safety), ruang lingkup; pengenalan anatomi & fisiologi, dasar istilah kedokteran	Mahasiswa memahami dasar-dasar, bidang, dan ruang lingkup Teknik Biomedika	Bab 1 [1], Bab 1 [2], Bab 1 [3]
3	Dasar-dasar Sistem/Instrumentasi Biomedika.	pengenalan anatomi & fisiologi, dasar istilah kedokteran. Dasar-dasar Sistem/Instrumentasi Biomedika: diagram blok, bagian-bagian & fungsinya, cara kerja sederhana, contoh-contoh alat bantu diagnosa & terapi sederhana; diagram rangkaian dan perhitungan soal sederhana	Mahasiswa memahami bagian-bagian sistem dan instrumentasi biomedika. Mahasiswa dapat menyebutkan fungsi dan cara kerja instrumentasi biomedika.	Bab 70 – 88 [1]
4	Dasar-dasar potensial bio-	prinsip, contoh-contoh,	Mahasiswa memahami dasar-dasar dan	Bab 4 – 6 [2], Bab 8 – 17 [1]

		karakteristik dan cara pengukurannya	konsep potensial biolistrik beserta pengukurannya.	
5	Berbagai jenis transducer & sensor biomedika	Pengukuran fisis, elektroda, sensor elektrokimia, sensor optik	Mahasiswa memahami konsep pengukuran fisis biolistrik dan biosinyal, elektroda. Mahasiswa dapat menyebutkan dan mengerti macam-macam sensor yang digunakan di teknik biomedika	Bab 47 – 51 [1], Bab 2 [2]
6	Penguat operasional & penguat biomedika.	Ideal Op-Amps, Inverting & noninverting Amplifiers, Integration, Differentiation	Mahasiswa memahami konsep penguatan di instrumentasi biomedika	Bab 3 [2]
7	Masalah keamanan (safety) pasien.	kejut listrik macroschock & microschock; beberapa alat pengaman dan program keamanan	Mahasiswa memahami dan mengerti berbagai macam masalah keamanan devais biomedika beserta cara penangannya.	Bab 13 [2]
8	Pengenalan anatomi & fisiologi.	Manfaat dan hubungannya dengan Teknik Biomedika	Mahasiswa mampu memahami hubungan antara teknik biomedika dengan ilmu anatomi dan fisiologi tubuh manusia.	Bab 1 – 7 [1]
9	Topik-topik khusus: Telemedika	e-health & telemedicine	Mahasiswa mampu memahami dan menerapkan aplikasi teknik biomedika di bidang telemedika	Bab 58 – 67 [4]
10	Topik-topik khusus: Biomekanika & Teknik Rehabilitasi	Gait analysis for rehabilitation	Mahasiswa mampu mengaplikasikan teknik biomedika di bidang biomekanika, khususnya gait analysis for rehabilitation.	Bab 18 – 36 [1]
11	Topik-topik khusus: Biomaterials & Tissue Engineering	Metallic Biomaterials, Ceramic Biomaterials, Polymeric Biomaterials, Composite Biomaterials, Biodegradable Polymeric Biomaterials: An Updated Overview, Biologic Biomaterials, Soft Tissue Replacements, Blood Interfacing Implants, Non-Blood-Interfacing Implants for Soft Tissues, Hard Tissue Replacements, Bone Repair and Joint Implants, Dental Implants: The Relationship of Materials Characteristics to Biologic Properties, Preservation Techniques for Biomaterials, Hip Joint Prosthesis Fixation—Problems and Possible Solutions	Mahasiswa mampu memahami berbagai macam jenis biomaterial beserta sifat-sifatnya. Mahasiswa mengetahui aplikasi biomaterial di bidang teknik biomedika.	Bab 37 – 46 [1]
12	Topik-topik khusus: Gelombang Elektromagnetik & ultrasonik	Ultrasound Transducers, Ultrasonic Imaging, Blood Flow Measurement Using Ultrasound, Electrical Impedance Tomography	Mahasiswa memahami karakteristik ultrasonic dan elektromagnetik beserta aplikasinya di teknik biomedika.	Bab 65 & 67 [1]
13	Perkembangan baru dalam Teknik Biomedika (I)	Tomografi, Medical Imaging	Mahasiswa mengerti dan memahami trend terbaru di teknik biomedika, khusus di bidang tomografi dan pencitraaan medis	Bab 62 – 64 [1]
14	Perkembangan baru dalam Teknik Biomedika (II)	Lab Clinic and Home use medical devais	Mahasiswa mengerti dan memahami trend terbaru di teknik biomedika, Studi kasus: devais medis di lab klinik dan rumah tangga.	Semua referensi dan referensi tambahan dari IEEE (terutama EMBS)
15	Kuliah penutup	Contoh topik-topik penelitian & tugas akhir; Ringkasan kuliah	Review topik-topik kuliah, contoh topik-topik penelitian	Semua referensi

Silabus dan Satuan Acara Pengajaran (SAP) EL5115

Kode Matakuliah: EL5115	Bobot sks: 3	Semester: Ganjil	KK / Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Anatomi Fisiologi dan Praktikum
	Anatomy Physiology and Lab. Works
Silabus Ringkas	Introduksi, Mekanisme Fisiologi Dasar, Sistem Kontrol Tubuh; Sistem Saraf, Sistem Lokomotorik; sistem skeletal, system muscular, Sistem Distribusi dan Pertukaran; Sistem cardiovascular, Sistem Respirasi, Sistem Urinari, wrap up & Pengayaan
	Introduction, Basic Physiology Mechanism, Integration & Control System; Nervous System, Loco-motoric system: skeletal system, muscular system, Exchange & distribution; Cardiovascular System, Respiratory System, Urinary System, wrap up & enhancement
Silabus Lengkap Introduction: level	Introduksi; orientasi dan level organisasi, kaitan Anatomi dan Fisiologi terhadap bidang engineering, parameter dan sinyal fisiologi, homeostasis. Mekanisme Fisiologi Dasar; Sel, transpor melalui membrane dan potensial membrane. Sistem integrasi dan Kontrol Tubuh; Organisasi selular Sistem Saraf, system saraf pusat dan perifer, sinaps Sistem Lokomotorik; sistem skeletal, jaringan dan fisiologi otot, system muscular. Sistem Distribusi dan Pertukaran; Sistem cardiovascular (organisasi dan fungsi, kelistrikan, mekanikal proses, vascular & hemodinamika, kontrol). Sistem Respirasi (organisasi dan fungsi, mekanikal properti, pertukaran dan transport gas, kontrol). Sistem Urinari ((organisasi dan fungsi, nefron dan fungsi dasar ginjal, peran ginjal pada homeostasis), wrap up & Pengayaan
	Introduction; orientation & organization level, relationship Anatomy & Physiology with biomedical engineering, physiological signal & parameter, homeostasis Basic Physiology Mechanism; cellular membranes and transport , membrane potential, cell communication, human body electricity Integration and Control System of the human body; Cellular organization of Nervous System , Central & Peripheral Nervous System, synaps Locomotoric System; Skeletal System, muscle tissue & physiology, muscular Sysytem Exchange and Distribution: Cardiovascular System (organization & function, electrical activity, mechanical event, vascular & hemodynamic, control). Respiratory System (organization & function, mechanical propertis, gas exchange & transport , control). Urinary system ((organization & function, Nefron & basic renal function, homeostatic) , wrap-up [Uraian lengkap silabus matakuliah dalam Bahasa Inggris (maksimum 100 kata)]

Luaran (Outcomes)	Setelah mengikuti mata kuliah ini mahasiswa selayaknya memiliki kemampuan:
	 - Mengerti dan mampu menerangkan konsep serta terminologi dasar anatomi dan fisiologi manusia
	 - Mampu menggunakan pengetahuan dasar anatomi & fisiologi tubuh manusia sebagai acuan kerangka berpikir dalam mempelajari lebih dalam mengenai bidang terkait, seperti sistem tubuh tertentu, farmakologi, dsb.
	 - Mampu menggunakan pengetahuannya dalam anatomi & fisiologi tubuh manusia sebagai acuan kerangka berpikir dalam melakukan penelitian/desain terkait biomedika di bidang ilmu masing-masing, sebagai contoh:
	    o Mahasiswa Teknik Elektro & Teknik Fisika: merancang instrumentasi biomedika dengan menggunakan prinsip-prinsip anatomi dan fisiologi manusia
	    o Mahasiswa Teknik Informatika: membuat program simulasi kerja fisiologi manusia
	    o Mahasiswa Teknik Mesin: aplikasi dalam bidang biomekanika
	    o Mahasiswa Matematika: mengembangkan pemodelan matematika dari sistem hidup
	    o Mahasiswa Kimia /Teknik Kimia: sebagai dasar mempelajari biokimia atau bidang terkait
	    o Mahasiswa Teknik Farmasi: sebagai dasar mempelajari farmakologi

Matakuliah Terkait	[Kode dan Nama Matakuliah] [Prasyarat, bersamaan, terlarang] [Kode dan Nama Matakuliah] [Prasyarat, bersamaan, terlarang]
Kegiatan Penunjang	Peragaan pemeriksaan sinyal-sinyal fisiologis
Pustaka	1. Widmaier, Raff, Strang, Vander's Human Physiology -The Mechanisms of Body Function, 12th edition, McGrawHill, 2011 (Pustaka utama)
	2. Joseph J Feher, Quantitative Human Physiology: An Introduction, 1th Academic Press, 2012 (Pustaka pendukung)
	3. http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2
Panduan Penilaian	Penilaian dilakukan berdasarkan nilai dari kuis, tugas, ujian mid-semester, serta ujian akhir
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduksi	a. Definisi, terminologi, kerangka referensi anatomis b. Ruang lingkup anatomi & fisiologi c. Kaitan anatomi & fisiologi terhadap Teknik Biomedika d. Organisasi tubuh manusia secara structural & fisiologis (system organ) e. homeostasis f. Karakteristik kehidupan g. Parameter dan Sinyal Fisiologi	• Mengetahui definisi anatomi dan fisiologi serta hubungan antara anatomi dan fisiologi • Mengetahui istilah anatomi untuk menjelaskan bagian, regio serta rongga tubuh, dan posisi relatif • Mengetahui fisiologi merupakan 'core' masalah bagi Teknik Biomedika • Mengetahui analogi sistem fisiologis terhadap sistem engineering • Memahami kemungkinan aplikasi engineering terhadap tubuh manusia	Pustaka 1, bab 1, sub-bab 1-8 Pustaka 2, bab 1, sub-bab 1 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu I

			• Dapat mengidentifikasikan level organisasi dari organisme, sistem organ pada manusia serta komponen-komponennya • Memahami konsep, mekanisme serta regulasi homeostasis serta pentingnya bagi kehidupan • Mengetahui karakteristik kehidupan organisme • Mengetahui berbagai jenis sinyal yang terdapat pada tubuh manusia	
2	Mekanisme Fisiologis Dasar	a. Sel dan Membran Sel b. transpor trans membran	a. Mengetahui struktur lokasi dan fungsi plasma membran b. Menjelaskan berbagai mekanisme transpor material melalui membran c. Menjelaskan prinsip fisika & kimia yang mendasari proses difusi, osmosis	Pustaka 1. Bab 3, sub bab1, 2 Pustaka 1, bab 4, sub bab1-5 Pustaka 2, bab2 sub bab 1, 5, 6, 7, 8 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu II
3	Mekanisme Fisiologis Dasar	c. Komunikasi antar sel d. Kelistrikan pada tubuh manusia	a. Menjelaskan mekanisme komunikasi antar sel b. Menjelaskan prinsip dasar kelistrikan pada tubuh manusia, c. Menjelaskan asal, konduksi potensial aksi	Pustaka 1. Bab 3, sub bab1, 2 Pustaka 1, bab 4, sub bab1-5 Pustaka 2, bab2 sub bab 1, 5, 6, 7, 8 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu III
4	Sistem Kontrol dan Integrasi Tubuh: Sistem Saraf	Komponen, Organisasi dan Fungsi system saraf	Menjelaskan komponen, organisasi sistem saraf	Pustaka 1. Bab 6 Pustaka 4, bab2 sub bab 1, 4, http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu III
5	Sistem Kontrol Tubuh: Sistem Saraf	Sinaps Aplikasi engineering pada system Saraf	mengetahui mekanisme transmisi sinyal pada sinap Memahami kemungkinan aplikasi engineering terhadap sistem kontrol, dengan sistem EEG sebagai contoh	Pustaka 1. Bab 6 Pustaka 2, bab 4, sub bab 2 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu V
6	Sistem Musculoskeletal: Sistem Skeletal	Komponen, organisasi dan fungsi sistem skeletal	Mengetahui organisasi dan fungsi system skeletal	http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, , materi kuliah minggu VI
7	Sistem Musculoskeletal: Sistem Muscular	Komponen, organisasi dan fungsi system muscular Jaringan otot Motor unit Sliding filament theory & kontrol Kelistrikan pada system muscular Aplikasi teknologi pada system musculoskeletal	Mengetahui organisasi otot skeletal dan fungsinya Memahami terjadinya kontraksi pada tingkat jaringan beserta mekanisme pengontrolannya Mengetahui neuromuscular junction, motor unit recruitment, excitation-contraction-couplng Memiliki wawasan mengenai aplikasi teknologi dalam sistem muscular, khususnya EMG	Pustaka 1, bab 9 Pustaka 2, bab 3 sub bab 4,5,6 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu VII
8	Sistem Kardiovaskular	Komponen dan organisasi secara keseluruhan Jantung sebagai sistem Listrik Sistem Kardiovaskular sebagai sistem mekanik Siklus jantung; Jantung sebagai pompa	Mengetahui struktur dan fungsi system kardiovaskular Mengetahui siklus jantung & hubungannya dengan kelistrikan dan suara jantung Memahami struktur, fungsi dan cara kerja jantung Mengetahui karakteristik potensial aksi pada sel otot jantung, sistem konduksi jantung, bagian gelombang EKG dan hubungannya dengan kontraksi jantung	Pustaka 12, bab 9 Pustaka 2, bab 5 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu VIII
9	Sistem Kardiovaskular	Sistem Vaskular & Hemodinamika Regulasi fungsi jantung Aplikasi teknologi pada system cardiovascular ECG & Pacemaker	Memahami struktur dan fungsi sistem vaskuler Memahami variabel sistem hemodinamik: volume, flow, pressure Memahami mekanisme kontrol jantung; regulasi intrinsik dan ekstrinsik Memiliki wawasan mengenai aplikasi teknologi dalam sistem kardiovaskular, khususnya EKG & Pacemaker	Pustaka 1, bab 9 Pustaka 2, bab 5 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu IX
10	Sistem Respirasi	Komponen dan organisasi system respirasi Proses mekanis pernafasan	Mengetahui komponen dan fungsi system respirasi Memahami proses masuk keluarnya udara beserta factor-	Pustaka 1, bab 13 Pustaka 2, bab 6 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu X

			faktor yang mempengaruhinya Memahami variabel dan fungsi sistem mekanik respirasi: pressure-volume relationship dan compliance dari sistem	
11	*Sistem Respirasi*	*Proses dan Pertukaran gas Transpor gas Aplikasi teknologi pada system respirasi: ventilator*	*Memahami proses pertukaran gas antara alveoli dan darah Memahami mekanisme perjalanan gas dari paru ke jaringan dan dari jaringan ke paru Memiliki wawasan mengenai aplikasi teknologi dalam sistem respirasi, khususnya ventilator dan alat pengukuran fungsi pernafasan*	*Pustaka 1, bab 13 Pustaka 2, bab 6 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu XI*
12	*Sistem Urinari*	*Komponen dan organisasi system urinary Nefron dan fungsi renal dasar*	*Memahami komponen dan fungsi sisten urinari Memahami proses pembentukan urin dan kerja ginjal: filtrasi, reabsorpsi, osmosis & counter-current multiplier system*	*Pustaka 1, bab 14 Pustaka 2, bab 7 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu XII*
13	*Sistem Urinari*	*Peran system urinary dalam system homeostasis Aplikasi teknologi pada system urinary: hemodialsisa*	*Memahami bagaimana tubuh menjaga kesetimbangan cairan : control osmolaritas, volume Memiliki wawasan mengenai aplikasi teknologi dalam sistem urinari, khususnya mesin hemodialisa*	*Pustaka 1, bab 14 Pustaka 2, bab 7 http://biomed.ee.itb.ac.id/kuliah/course/view.php?id=2, materi kuliah minggu XIII*
14	*Pengayaan*	*Integrated Physiology: Distribution & exchange*	*Memahami interaksi system kardiovaskular, respirasi dan urinari dalam mendistribusikan nutrisi dan waste product*	
15	*Resume*			

Silabus dan Satuan Acara Pengajaran (SAP) EL5116

Kode Matakuliah: EL5116	*Bobot sks:* 2	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Fisika Sistem Hidup
	Physics of Living System

Silabus Ringkas	Pendahuluan. Mekanika dan aplikasinya. Pertumbuhan dan peluruhan eksponensial. Transport pada medium tak berhingga. Transport melalui membran. Sifat-sifat listrik sel saraf dan miokardial. Electrocardiography. Umpan balik dan kontrol pada sistem biologi.

Silabus Lengkap	Pendahuluan. Mekanika dan aplikasinya: kesetimbangan mekanik pada sistem tubuh, dan kerja pada organ biologi. Pertumbuhan dan peluruhan eksponensial. Transport pada medium tak berhingga. Transport melalui membran: dasar-dasar, ginjal buatan, persamaan Goldman. Sifat-sifat listrik sel saraf: dasar-dasar, persamaan, contoh. Sifat-sifat listrik sel miokardial: distribusi muatan listrik pada sel miokardial, potensial listrik sel miokardial terpolarisasi, momen dipol jantung sebagai fungsi waktu, electrocardiographic leads, elektrokardiogram. Umpan balik dan kontrol pada sistem biologi: dasar-dasar, contoh.
	Introduction. Mechanics and it's application: forces in the skeletal system; fluid flow, with examples from the circulatory system. Exponential Growth and Decay. Systems of Many Particles. Transport in an Infinite Medium. Transport Through Neutral Membranes. Impulses in Nerve and Muscle Cells. The Exterior Potential and the Electrocardiogram. leads to the current dipole model for the electrocardiogram. Biomagnetism. Electricity and Magnetism at the Cellular Level. Feedback and Control: Examples of feedback systems include Cheyne-Stokes respiration, heat stroke, pupil size.

Luaran (Outcomes)	1. Memahami ruang lingkup sifat-sifat fisis di sistem biologi, terutama tubuh manusia 2. Memahami secara teori dan mengimplementasikan aspek dari sifat-sifat fisis tubuh, terutama biolistrik 3. Mampu menganalisis masalah fisika sistem hidup dan merancang solusinya. 4. Mampu mengidentifikasi implementasi terkini di bidang fisika sistem hidup yang diaplikasikan di Teknik Biomedika.

Matakuliah Terkait	EL5101 Anatomi Fisiologi & Praktikum	Prasyarat

Kegiatan Penunjang	

Pustaka	Russel K.Hobbie, Intermediate Physics for Medicine and Biology, Springer Verlag, 1997
	Vander Sherman, Luciano: Human Physiology, McGraw-Hill Inc.,New York,1994
	Park S.Nobel, Introduction to Biophysical Plant Physiology, Freeman and Co.,1985

Panduan Penilaian	Tugas 20%, Kuis 20 %, UTS 30%, UAS 30 %

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pendahuluan.			Bab 1 [1]
2	Mekanika dan aplikasinya.			Bab 2 [1]
3	Pertumbuhan dan peluruhan eksponensial.			Bab 3 [1]
4	Transport pada medium tak berhingga.			Bab 4 [1]
5	Transport melalui membran.			Bab 5 [1]
6	Sifat-sifat listrik sel saraf dan miokardial I			Bab 6 [1]
7	Sifat-sifat listrik sel saraf dan miokardial II			Bab 6 [1]
8	Electrocardiography I			Bab 7 [1]
9	Electrocardiography II			Bab 7 [1]
10	Electromyography I			Bab 7 [1]
11	Electromyography II			Bab 7 [1]
12	Electroencephalography I			Bab 7 [1]
13	Electroencephalography II			Bab 7 [1]
14	Umpan balik dan kontrol pada sistem biologi			Bab 10 [1]
15	Tugas Besar			Semua referensi + berbagai sumber yang relevan

Silabus dan Satuan Acara Pengajaran (SAP) EL5117

Kode Matakuliah: EL5117	Bobot sks: 2	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Arsitektur Berbasis Layanan
	Service Oriented Architecture
Silabus Ringkas	
	Give students knowledge about Service Oriented Architecture
Silabus Lengkap	
	Give students knowledge about : SOA Concept, SOA Case Study, SOA and Web Services Fundamentals, SOA and WS-* Extension, SOA and Service Orientation, Building SOA (Planning and Analysis), Building SOA (Technology and Design)
Luaran (Outcomes)	
Matakuliah Terkait		
Kegiatan Penunjang	
Pustaka	1. Thomas Erl, Service Oriented Architecture - Concepts, Technology and Design, Prentice Hall, 2005

Panduan Penilaian	Homework	0%	Homework (assignments) are mandatory
	Quiz	0%	One mandatory online quiz
	Exam		No exam
	Project	100%	Technical report (paper), 15 pages

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			1 (Chapter 1)
2	SOA Concept			1 (Chapter 2)
3	SOA Case Study			1 (Chapter 2)
4	SOA and Web Services Fundamentals			1 (Chapter 3)
5	Database Technology : DBMS			1 (Chapter 4)
6	SOA and WS-* Extension			1 (Chapter 5)
7	SOA and Service Orientation			1 (Chapter 5)
8	Midterm Exam Week			
9	Building SOA (Planning and Analysis)			1 (Chapter 6)
10	Case Study Presentation + Discussion			1 (Chapter 6)
11	Case Study Presentation + Discussion			
12	Case Study Presentation + Discussion			
13	Case Study Presentation + Discussion			
14	Case Study Presentation + Discussion			
15	Case Study Presentation + Discussion			

Silabus dan Contoh Satuan Acara Pengajaran (SAP) EL5119

Kode Matakuliah: EL5119	Bobot sks: 2	Semester: Ganjil	KK / Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Rekayasa Basis Data			
Silabus Ringkas				
	Give students knowledge about enterprise database concepts			
Silabus Lengkap				
	Give students knowledge about : Database Concept; Evolution of Database Design Methodology; Database Technology : DBMS, Data Modelling, Relational Database; Object Oriented Database; Distributed Database; Multimedia Database Management System; Data Mining, Meta Data, Data Warehouse, Information Quality			
Luaran (Outcomes)				
Matakuliah Terkait	Keamanan Informasi		Prasyarat	
Kegiatan Penunjang				
Pustaka	Al Hakim, Latif, Information Quality Management : Theory & Application, Idea Group Publishing, 2007			
	Davis, Jim, Information Revolution using the Information Evolution Model to Grow Your Business, Wiley			
	Hand, David, Mannilia, H., Smyth, P. ,Principles of Data Mining, MIT Press, 2001			
	Inmon, W.H., Building the Data Warehouse 3rd edition, John Wiley & Sons Inc., 2002			
	Moss, L.T., Atre Shaku, Business Intelligence Roadmap, Addison Wesley, 2003			
	Piattini, M., Diaz, O. , Advanced Database Technology and Design, Artech House Inc., 2000			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			Chapter 1
2	Database Concept			Chapter 2
3	Database Concept			Chapter 2
4	Evolution of Database, Design Methodology			Chapter 3
5	Database Technology : DBMS			Chapter 4
6	Database Technology : Data Modelling			Chapter 5
7	Database Technology : Data Modelling			Chapter 5
8	Midterm Exam Week			
9	Relational Database			Chapter 6
10	Combinational Circuit Building Blocks			Chapter 6
11	Object Oriented Database			Chapter 7
12	Distributed Database			Chapter 8
13	Meta Data			Chapter 9
14	Data Mining & Warehousing			Chapter 10
15	Information Quality			Chapter 8

Silabus dan Contoh Satuan Acara Pengajaran (SAP) EL5121

Kode Matakuliah: EL5121	Bobot sks: 2	Semester: Ganjil	KK / Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Pengembangan Aplikasi Berorientasi Object			
	Object Oriented Application Development			
Silabus Ringkas				
	Intro to Application Development. App Development Life Cycle and Detail Processes. Object Oriented Concept. Object Oriented Modeling (UML). UML and Detail Description.			
Silabus Lengkap				
	1. Know App Development Life Cycle. 2. Know Main Process in Application Development. 3. Know Object Oriented Concep and Its Implementation in App Development. 4. Know UML, all UML Diagram and Its Detail Description. 5. Model Application by UML.			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	Software Engineering 6th ed, Roger S. Pressman, McGraw-Hill			
	UML 2.0 Toolkit			
Panduan Penilaian	Homework, Quiz, Exam, Project			
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Intro to Software Engineering			
2	Application Development Life Cycle			
3	OO Analysis			
4	OO Design			
5	Software Testing			
6	Intro to UML			
7	Use Case Modeling			
8	Midterm Exam Week			
9	Class & Object Modeling			
10	Sequence Diagram			
11	Other UML Diagram			
12	Case Study			
13	Project & Discussion			
14	Project & Discussion			
15	Project & Discussion			

Silabus dan Contoh Satuan Acara Pengajaran (SAP) EL5124

Kode Matakuliah: EL5124	Bobot sks: 2	Semester: Ganjil	KK / Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Organisasi Sistem Komputer			
Silabus Ringkas				
Silabus Lengkap	This course will give you an in-depth understanding of the inner-workings of modern digital computer systems and tradeoffs present at the hardware-software interface. You will get an understanding of the design process in the context of a complex hardware system and practical experience with computer-aided design tools. Topics include: Instruction set design, computer arithmetic, controller and datapath design, memory systems, input-output systems, networks interrupts and exceptions, pipelining, performance and cost analysis, computer architecture history, and a survey of advanced architectures.			
Luaran (Outcomes)	This course is intended for undergraduate student so that the student will gain a comprehensive knowledge of computer hardware and its interaction with software.			
Matakuliah Terkait	Digital System		Prasyarat	
Kegiatan Penunjang				
Pustaka	Randal E. Bryant, David R., Computer Systems A Programmer's Perpective, 2nd Ed, 2010 [CSAP]			
	John L. Hennessy and David A. Patterson , Computer Organization and Design: The Software Hardware Interface, Morgan Kaufmann Publishers, Fourth Edition, 2009. [P&H]			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction	History of computers Performance Analysis		[P&H] Ch1
2	Integer Operations	Unsigned and Signed Numbers. Range, Arithmetic Operations		[CSAP] Ch2
3	Floating Point	IEEE754, Representation, Range, Precision, Rounding, and Arithmetic operations		[CSAP] Ch2
4	Intel's ISA	Data Formats, Accesing Information, ALU Ops, Control		[CSAP] Ch3
5	Intel's ISA	Control and Procedure		[CSAP] Ch3
6	Intel's ISA	Array allocations, Structures, and unions		[CSAP] Ch3
7	Memory Hierarchy	Memory Technology, Cache		[P&H] Ch5, [CSAP] Ch6
8	Memory Hierarchy	Virtual memory		[P&H] Ch6, [CSAP] Ch10
9	I/O Subsystem	Peripherals and Storage		[P&H] Ch6
10	Introduction to Superscalar	Performance Enhancement, ILP, Speculative execution, branch predictions, multithreading, SSE, Altivec		[P&H] Ch7
11	Parallel and Distributed System	Taxonomy, granularity, system examples		[P&H] Ch7
12	Final Exam			

Silabus dan Satuan Acara Pengajaran (SAP) EL5126

Kode Matakuliah: EL5126	Bobot sks: 2	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Prodi

Nama Matakuliah	Perancanaan Strategis Teknologi Informasi
	Information Technology Strategic Plan
Silabus Ringkas	
	Introduction of Information Technology Strategy, Information Technology and Competitive Advantage, Assessment, Strategy, Execution, Quality Control, Administration and Organization
Silabus Lengkap	
Luaran (Outcomes)	1. Students are able to understand the key points that underlie the need for Information Technology Strategy 2. Students able to analyze various methods of preparation of the Information Technology Strategy 3. Students understand some of the methods of preparation of the information technology strategy 4. Students can develop the Information Technology Strategy in a particular case by using appropriate methods
Matakuliah Terkait	EL6211 – Manajemen Resiko Teknologi Informasi	Pre-requisite / Co-requisite
	EL6213 - Tata Kelola dan Audit Teknologi Informasi	Pre-requisite / Co-requisite
	EL6214 – Manajemen Proyek Teknologi Informasi	Pre-requisite / Co-requisite
Kegiatan Penunjang	Kuliah (2 jam/minggu) Responsi (2 jam/minggu)
Pustaka	1. Boar, Bernard, The Art of Strategic Planning for Information Technology, Wiley2001
	2. Verzin, Markus, The Strategy Process: A Practical Handbook for Implementation in Business
	3. John Ward & Joe Peppard, Strategic Planning for Information Systems
	4. Benson, Robert J., From Business Strategy to IT Action
	5. Keyes, Jessica, Implementing The IT Balanced Scorecard
Panduan Penilaian	Homework 50% Project 50%
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	- StrategicPlanning for IT - Managing IT for Competitive Advantage			[1] Chapter 1, 2
2	Assesment			[1] Chapter 3
3	Strategy			[1] Chapter 4
4	The Evolving Role of IS & IT in Organizations: A Strategy Perspective			[2] Chapter 1
5	- An Overview of Business Strategy Concepts & the IS/IT Strategy Implications - Developing an IS/IT Strategy			[2] Chapter 2,3
6	IS/IT Strategic Analysis : Assesing & Understanding the Current Situation			[2] Chapter 4
7	IS/IT Strategic Analysis : Determining the Future Potential			[2] Chapter 5
8	Determining the Business IS Strategy Managing the Application Portfolio			[2] Chapter 6,7
9	Strategic Management of IS/IT			[2] Chapter 8,9
10	Managing Investments in IS & IT			[2] Chapter 10
11	Managing the Supply of IT, Applications & Infrastructure			[2] Chapter 11

12	Define the Goals of Business Strategy to IT Action Connect to the Bottom Line			[3] Chapter 1,2,3
13	Understand Costs & Resources Adopt Effective Process to Prodeuce Action			[3] Chapter 4,5
14	Make the Right Decisions			[3] Chapter 8
15	Plan for The Right Results			[3] Chapter 9
16	Final Assignment all sections			

Silabus dan Satuan Acara Pengajaran (SAP) EL5201

Kode Matakuliah: EL5201	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Pengujian dan Keterujian Sistem Digital
	Digital System Testing & Testable Design
Silabus Ringkas	
Silabus Lengkap	Part 1: Introduction to testing covers the important of testing, type of testing, economics aspect and fault modeling. Part 2: Test methods cover modeling circuits, algorithms for fault simulation and test generation for combinational circuits. Part 3 Design for testability covers digital DFT and scan design, and built-in self-test.
Luaran (Outcomes)	
Matakuliah Terkait	Digital System — Prasyarat
Kegiatan Penunjang	
Pustaka	M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2000. (1)
	M. Abramovici, M.A. Breuer, and A.D. Friedman, "Digital System Testing & Testable Design", Computer Science Press, W.H. Freeman & Company, 1990.
	Digital Logic Testing & Simulation, Miczo, Harper & Row, 1986.
	B. R. Wilkins, Van Nostrand Reinhold, "Testable Digital Circuits: An Introduction", Berkshire, UK, 1986.
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction, Vlsi Testing Process And Test Equipment			(1) Chapter 1, 2
2	Test Economics And Product Quality			(1) Chapter 3
3	Fault Modeling			(1) Chapter 4
4	Logic And Fault Simulation			(1) Chapter 5
5	Testability Measures			(1) Chapter 6
6	Combinational Circuit Test Generation			(1) Chapter 7
7	Sequential Circuit Test Generation			(1) Chapter 8
8	Memory Test			(1) Chapter 9
9	Dsp-Based Analog And Mixed-Signal Test			(1) Chapter 10
10	Model-Based Analog And Mixed-Signal Test			(1) Chapter 11
11	Delay Test			(1) Chapter 12
12	Iddq Test, Digital Dft And Scan Design			(1) Chapter 13, 14
13	Built-In Self-Test			(1) Chapter 15
14	Boundary Scan Standard, Analog Test Bus Standard			(1) Chapter 16, 17
15	System Test And Core-Based Design			(1) Chapter 18

Silabus dan Satuan Acara Pengajaran (SAP) EL5202

Kode Matakuliah: EL5202	*Bobot sks:* 3	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Mesin Sekuensial
	Sequential Machine
Silabus Ringkas	
	Fault detection of combinational circuits. Representation, equivalents, reduction, decomposition and fault detection of sequential machines.
Silabus Lengkap	
Luaran (Outcomes)	
Matakuliah Terkait	Sequential Circuit Design / Prasyarat
Kegiatan Penunjang	
Pustaka	Zamir Bavel, "Introduction to the theory of automata", Reston Pub. Co. 1983
	Zvi Kohavi, "Switching and Finite Automata Theory", McGraw-Hill, 1979
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Kunci Kombinasi, Puzzel 3 Ember			
2	Definisi Mesin dan Submesin, Struktur Lain			
3	Otomata Hingga			
4	Otomata yang dibangkitkan oleh himpunan state			
5	Keterhubungan dalam Otomata			
6	Para pembangkit			
7	Sumber	Pendahuluan, Sumber		
8	Sumber	Sumber dan himpunan suksesor		
9	Sumber	Sumber dan subotomata		
10	Semigroup	Pendahuluan, Semigroup masukan dari sebuah otomata hingga		
11	Semigroup	Monoid masukan dari sebuah subotomata		
12	Semigroup	Semigroup automaton		
13	Semigroup	Sebuah aplikasi: semigroup-semigroup hingga		
14				

Silabus dan Satuan Acara Pengajaran (SAP) EL5203

Kode Matakuliah: EL5203	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Pemrograman Lanjut			
	Advanced Programming			
Silabus Ringkas	Kuliah ini memberikan pengetahuan yang lebih dalam tentang pengertian struktur data dan algoritma, serta pemrograman berorientasi obyek.			
Silabus Lengkap	Memberikan pengetahuan yang lebih dalam tentang pengertian struktur data dan algoritma, yang mencakup pengertian linked lists, hashing, sorting, searching, stacks, queues, trees, and graphs. Penerapannya dalam pemecahan masalah dan perancangan berorientasi obyek. Mencakup juga definisi rekursif dan algoritmanya.			
Luaran (Outcomes)	1. Memahami pengertian tentang linked lists, hashing, sorting, searching, stacks, queues, trees, and graphs. 2. Memahami pemecahan masalah dan perancangan berorientasi obyek. 3. Implementasi perancangan struktur data dan algoritma menggunakan bahasa pemrograman C++/Java/C#.			
Matakuliah Terkait	IF2030 Algoritma dan Struktur Data	Prasyarat		
Kegiatan Penunjang				
Pustaka	Hanly, Jeri, and Koffman, Elliot, "Problem Solving and Program Design in C", 7 ed, PEARSON Addison Wesley, New York, 2013			
	Eide, Arvid R., et. al., "Engineering Fundamentals and Problem Solving", 4ed, McGraw Hill, New York, 2002			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	C programming language	summary of differences pre-processor strings stdio pointers and pointer arithmetic malloc/free unions function pointers		
2	Software development models, including open source	Unix make automake autoconf -- cross-platform development CVS doc++ and other documentation tools Oxygen gdb and DDD purify, ElectricFence truss		
3	profiling: gprof			
4	Windows	Visual C Code Warrior		
5	Program models: data driven, event driven, cgi, RPC, etc			
6	UML			
7	Data interchange	classical Unix style serialization XML		
8				
9				
10				

Silabus dan Satuan Acara Pengajaran (SAP) EL5204

Kode Matakuliah: EL5204	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Sistem Fault Tolerant			
	Fault Tolerant System			
Silabus Ringkas				
Silabus Lengkap				
	Computers and networks are increasingly used in critical applications, where system failures can be expensive or even catastrophic. Example applications include aircraft fly-by-wire control, automobile control, computers used in medical systems, spacecraft, and databases in large variety of financial and enterprise applications. The overall reliability expected of a computer system in these applications far exceeds that of any individual computer. This course is about how to build a highly reliable system that continue to function acceptably even after a number of its components (hardware or software) have failed.			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	D.K. Pradhan, "Fault-Tolerant Computer System Design", Prentice-Hall, 1996.			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction: Motivation, System view of high availability design, Two commercial examples (Stratus and Chameleon)			
2	Probability review, distributions			
3	Hardware redundancy: Basic approaches, Static & Dynamic, Voting, Fault tolerant interconnection networks			
4	Error detection techniques: Watchdog processors, Heartbeats, Consistency and capability checking, Data audits, Assertions, Control-flow checking			
5	Software fault tolerance: Process pairs, Robust data structures, N version programming, Recovery blocks, Replica consistency & reintegration, Multithreaded programs			
6	Network fault tolerance: Reliable communication protocols, Agreement protocols, Database commit protocols			
7	Practical steps in design of high availability networked systems			
8	Experimental Evaluation: Modeling			
9	Checkpointing & Recovery			
10	Experimental Evaluation: Simulation and Fault-injection based			
11	Practical Systems for Fault Tolerance: Putting it all together			
12	Discussion of projects			
13	Presentation of projects			
14	Tests			

Silabus dan Satuan Acara Pengajaran (SAP) EL5205

Kode Matakuliah: EL5205	*Bobot sks:* 3	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Komputasi Bergerak dan Komputasi Pervasif
	Mobile and Pervasive Computing

Silabus Ringkas	

Silabus Lengkap	Design issues for ubiquitous computing; integration and processing of sensor-based input; wireless infrastructures; security and user-interfaces; integrated, multimodal input and output and application areas. Students will read a number of papers on these and related areas, and a required term project will allow students to apply these concepts in a real-world application. Other mobile topics includes: • Cellular Networks: Channel allocation, Location management, Handoffs. • Wireless Networking: MAC protocols, Routing, Transport, Ad-hoc networking. • Applications: Mobility adaptations, Disconnected operations, Data broadcasting, Mobile agents. • Others: Security, Energy efficient computing, Impact of mobility on algorithms.

Luaran (Outcomes)	

Matakuliah Terkait	Advanced Computer Network	Prasyarat

Kegiatan Penunjang	

Pustaka	Perkins, C., "Mobile IP", Addison Wesley, 1999.
	Perkins, C., "Adhoc Networks", Addison Wesley, 2000.
	Aggelou, G., "Mobile Ad Hoc Networks: From Wireless LANs to 4G Networks", McGraw Hill, 2005.
	Basagni, S. et. al., "Mobile Ad Hoc Networking", John Wiley and Sons, 2004.
	Burkhardt, Henn, Hepper, Rintdorff, Schaeck. "Pervasive Computing: Technology and Architecture of Mobile Internet Applications", Addison Wesley, 2002.
	Ian Foster and Carl Kesselman. "The Grid 2: Blueprint for a New Computing Infrastructure", Morgan Kaufmann Publishers, 2004.

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Session Mobility			
2	Computation Migration			
3	Cyber Foraging			
4	Sensors Networks			
5	Opportunistic Sensing			
6	RFID			
7	Activity Recognition			
8	Wireless Authentification			
9	Privacy			
10	Wireless Networking	Multiple Radios Directional Antennas		
11	Vehicular Networking			
12				
13				
14				

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Silabus dan Satuan Acara Pengajaran (SAP) EL5206

Kode Matakuliah: EL5206	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Jaringan Multilayanan dan Multimedia			
	Multi-Service and Multimedia Network			
Silabus Ringkas				
Silabus Lengkap	Introduction to multimedia networks. Quality of service and traffic characteristics. Traffic scheduling. Multicasting mechanisms. Resource reservation. Multimedia communication protocols. Networked multimedia applications issues. The second part of the course will deal with Introduction to multi-service ; service development, development of multi-service network technology, review of stochastic processes, multi-service traffic model, queue network model, QoS multi-service network, network planning method, multi-service network technology election.			
Luaran (Outcomes)				
Matakuliah Terkait	Advanced Computer Network	Prasyarat		
Kegiatan Penunjang				
Pustaka	John Blommers, "Practical Planning for Network Growth", Prentice-Hall Inc., 1996.			
	David McDysan, "QoS and Traffic Management in IP and ATM Networks", McGraw-Hill, 2000.			
	Grenville Armitage, "Quality of Service in IP Networks", Tearson Higher Education, 1st Ed., 2000.			
	F. Halsall, "Multimedia Communications Applications, Networks, Protocols and Standards", Wesley, 2001.			
	K.R. Rao and Z.S. Bojkovic, "Packet Video Communications over ATM Networks", Prentice Hall, 2000.			
	Ze-nian Li and Mark S. Drew, "Fundamentals of Multimedia", Prentice Hall, 4th Ed., 2003.			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction and Logistics			
2	Digital Coding Techniques and Standards	Audio Coding Image Coding Video Coding		
3	Multimedia Compression and Resiliency	Codecs Adaptive Coding Error Handling Techniques		
4	Multimedia network Services and Applications	Wireless Broadband Broadcast TV and Video Streaming QOS		
5	Media Transport Protocols	Session Initiation Protocol (SIP) Real-Time Streaming Protocol (RTSP) Real-Time Transport Protocol (RTP) Session Description Protocol (SDP)		
6	Media Transport - Security Issues/Techniques and Compression	Firewalls, NATs, IPSec and Secure RTP Header Compression		
7	Next-Generation Multimedia Network Architecture	Standards: Multiservice Switching Forum Architecture, 3 GPP, ETSI TISPAN, Architecure NGN Components, Protocols Multimedia Network Issues Digital Rights Management (DRM)		
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Silabus dan Satuan Acara Pengajaran (SAP) EL5208

Kode Matakuliah: EL5208	*Bobot sks:* **2**	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Teknologi IC Lanjut
	Advanced IC Technology
Silabus Ringkas	
Silabus Lengkap	
	Microelectronic processing of solid-state devices and integrated circuits. Process techniques such as lithography, oxidation, diffusion, film deposition, etch, ion implantation, and back-end processing will be discussed. Integration of processes for bipolar, CMOS, BiCMOS, and MEMS fabrication processes. Defining system rules for IC layout. Packaging and yield.
Luaran (Outcomes)	Students should be able to: • Explain the process flow for different microelectronic processes. • Describe the processing steps (including the chemical and physical basis,) manufacturing techniques, measurement techniques, and important output parameters. • Relate device characteristics to key process parameters. • Use design rules to layout simple circuits and calculate yield.
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Fabrication Engineering at the Micro- and Nanoscale, Stephen A. Campbell, Oxford University Press 2008
	James D. Plummer, Michael D. Deal and Peter B. Griffin, Silicon VLSI Technology: Fundamentals, Practice and Modeling, Prentice Hall, Upper Saddle River, New Jersey, 2000
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction, Substrates			
2	Diffusion			
3	Oxidation			
4	Implantation			
5	Rapid Thermal Processing			
6	Optical Lithography			
7	Photoresist			
8	Non-optical Litho			
9	Vacuum/plasma			
10	PVD: Physical Vapor Deposition			
11	CVD: Chem Vapor Depos'n			
12	Epitaxy			
13	Back-end Processing			
14	Manufacturing			
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Silabus dan Satuan Acara Pengajaran (SAP) EL5209

Kode Matakuliah: EL5209	*Bobot sks:* 3	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Rangkaian Terintegrasi Frekuensi Radio
	Radio Frequency Integrated Circuit

Silabus Ringkas	Mata kuliah ini membahas perancangan *transceiver* radio. Bahasan meliputi arsitektur tranceiver dan rangkaian pembentuk-nya. Rangkaian-rangkaian ini meliputi *mixer*, penguat *low noise*, penguat daya frekuensi radio, dan bagian front end lainnya
	This course discusses the design of radio tranceiver. The topics include transceiver architecture and its building circuits. These circuits are mixer, low noise amplifier (LNA), and other part of the analog front end transceiver

Silabus Lengkap	- Dasar-dasar perancangan *transceiver* radio - arsitektur transmitter - arsitektur receiver *mixer* - penguat *low noise* - penguat daya frekuensi radio - distorsi dan noise - modulasi analog dan digital - studi kasus perancangan transceiver radio
	- Basics of radio transceiver design - Transmitter architecture - Receiver architecture - mixer - low noise amplifier - RF power amplifer - distortion and noise - modulation (analog and digital) - RF Transceivers Case Studies

Luaran (Outcomes)	1. Peserta mengerti dan dapat melakukan *perancangan IC analog* dan *mixed signal* 2. Peserta mengetahu topik-topik lanjut dalam perancangan IC analog dan mixed signal
Matakuliah Terkait	Elektronika 2 — Prasyarat
Kegiatan Penunjang	Simulasi, pratikum, project
Pustaka	
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	RF Integrated Circuits	- RF Block and System Design Parameters - Distortion Analysis - Aerial Access - Analog & Digital Modulation - Receiver Architecture - Transmitter Architecture - Phase Noise - RF Transceivers Case Studies	To introduce basic design techniques of radio frequency integrated circuits used in wireless communications and other mobile applications	
2	Analog Integrated Circuits	- Integrated circuit device models - VLSI technologies - Transistor amplifier architectures - Current mirrors, current sinks and sources - Reference sources - Output stages	Students will learn the basic principles of designing analog integrated circuits	
3	Analog VLSI	- CMOS Current division analog VLSI circuits - Gain boosting	1. Learn design techniques of analog VLSI circuits. Design a VLSI chip and submit it over the internet	

		techniques • Rail to Rail input and output stages • Analog design in BiCMOS technologies • Sigma delta data converters • Statistical design of analog VLSI circuits • Layout techniques for • analog and mixed signal VLSI	for fabrication. Students are encouraged to enroll for one credit hour after the course to test the chips after fabrication 2. Provide students an opportunity to practice team work and communicate their design experience orally and in writing	
4	Low Power Mixed Signal VLSI	• Noise in mixed signal chip • Low voltage low power CMOS Opamps and comparators • Sample and hold circuits, switched capacitor circuits • Digital to analog converters	*1.* To learn design techniques of low power mixed analog/digital integrated circuits particularly in standard CMOS technology *2.* Learn to apply these techniques in telecommunications and sensor interface chips	
5	Hierarchical Design, Capture, and Verification of Mixed Signal Systems	• Introduction, overview of mixed signal system design flow, analog design flow, course plan • Mixed signal and system descriptions and simulations; Joint Spice and HDL simulation strategies • Top down design with bottom up verification flows • Mixed signal testbenches - Analog verification vs. Digital verification • Behavioral descriptions: Statements, operators, and events • Declarations and structural descriptions • Basic examples: Common sourse amplifiers, inverters, logic gates; Basic Op Amp, flip flops, data busses; Voltage • regulators • Project Formulation	1. Learn the advanced principles of combining analog and digital simulation strategies for design and verification of mixed signal systems 2. Develop capabilities in using modern CAD tools for complete system design -- initial specifications to manufactureable descriptions	
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Silabus dan Satuan Acara Pengajaran (SAP) EL5210

Kode Matakuliah: EL5210	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Perancangan IC Analog dan Mixed Signal
	Analog and Mixed Signal IC design
Silabus Ringkas	Mata kuliah ini membahas dasar perncangan IC analog, A/D dan D/A converter, dan teknik-teknik dasar yang digunakan (*switch capacitor, charge pump, …*)
	This course discusses the basics of analog IC design, A/D-D/A converter, various technique in analog IC design
Silabus Lengkap	- Dasar-dasar perancangan *transceiver* radio - arsitektur transmitter - arsitektur receiver *mixer* - penguat *low noise* - penguat daya frekuensi radio - distorsi dan noise - modulasi analog dan digital - studi kasus perancangan transceiver radio
	- Basics of radio transceiver design - Transmitter architecture - Receiver architecture - mixer - low noise amplifier - RF power amplifer - distortion and noise - modulation (analog and digital) - RF Transceivers Case Studies
Luaran (Outcomes)	3. Explain various architecture of RF transceiver 4. Explain building circuits of transceiver 5. design radio frequency integrated circuits used in wireless communications and other mobile applications
Matakuliah Terkait	Elektronika 2 Prasyarat
Kegiatan Penunjang	Simulasi, pratikum, project
Pustaka	
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	RF Integrated Circuits	- RF Block and System Design Parameters - Distortion Analysis - Aerial Access - Analog & Digital Modulation - Receiver Architecture - Transmitter Architecture - Phase Noise - RF Transceivers Case Studies	To introduce basic design techniques of radio frequency integrated circuits used in wireless communications and other mobile applications	
2	Analog Integrated Circuits	- Integrated circuit device models - VLSI technologies - Transistor amplifier architectures - Current mirrors, current sinks and sources - Reference sources - Output stages	Students will learn the basic principles of designing analog integrated circuits	
3	Analog VLSI	- CMOS Current division analog VLSI circuits - Gain boosting techniques - Rail to Rail input and output stages - Analog design in BiCMOS technologies - Sigma delta data	3. Learn design techniques of analog VLSI circuits. Design a VLSI chip and submit it over the internet for fabrication. Students are encouraged to enroll for one credit hour after the course to test the chips after fabrication.	

		converters		
		• Statistical design of analog VLSI circuits • Layout techniques for • analog and mixed signal VLSI	4. Provide students an opportunity to practice team work and communicate their design experience orally and in writing.	
4	Low Power Mixed Signal VLSI	• Noise in mixed signal chip • Low voltage low power CMOS Opamps and comparators • Sample and hold circuits, switched capacitor circuits • Digital to analog converters	3. To learn design techniques of low power mixed analog/digital integrated circuits particularly in standard CMOS technology 4. Learn to apply these techniques in telecommunications and sensor interface chips	
5	Hierarchical Design, Capture, and Verification of Mixed Signal Systems	• Introduction, overview of mixed signal system design flow, analog design flow, course plan • Mixed signal and system descriptions and simulations; Joint Spice and HDL simulation strategies • Top down design with bottom up verification flows • Mixed signal testbenches - Analog verification vs. Digital verification • Behavioral descriptions: Statements, operators, and events • Declarations and structural descriptions • Basic examples: Common sourse amplifiers, inverters, logic gates; Basic Op Amp, flip flops, data busses; Voltage • regulators • Project Formulation	3. Learn the advanced principles of combining analog and digital simulation strategies for design and verification of mixed signal systems. 4. Develop capabilities in using modern CAD tools for complete system design -- initial specifications to manufactureable descriptions	
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Silabus dan Satuan Acara Pengajaran (SAP) EL5211

Kode Matakuliah: EL5211	*Bobot sks:* 2	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Sistem Kendali Nonlinear
	Nonlinier Control System

Silabus Ringkas	
	Introduction, describing function analysis, phase plane analysis, sliding mode control, Lure's problem: anti-windup and constrained model predictive control examples, Kalman-Yakubovich-Popov Lemma and linear matrix inequalities, Lypunov stability theory and applications, feedback linearization

Silabus Lengkap	

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	J-J. E. Slotine & W. Li, Applied Nonlinear Control, Prentice Hall International, New Jersey, 1991 (Slotine)
	K. Ogata, Modern Control Engineering, Prentice Hall of India, New Delhi, 1985 (Ogata)
	H. K. Khalil, Nonlinear Systems, Macmillan Publishing Co., New York, 1992 (Khalil)
	R.A. DeCarlo, S.H. Zak, G.P. Matthews, Variable Structure Control of Nonlinear Multivariable Systems: A Tutorial, Proceedings of The IEEE, Vol.76, No.3, March 1998. (DeCarlo)

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Linier vs Nonlinear systems; Describing Function (DF)	Characteristics of nonlinier systems, describing function concept, review Fourier Series		Ogata, Slotine
2	Describing function analysis	DF of memoryless nonlinarities, DF plot vs Nyquist plot, Stability analysis, limit cycle & its predictions		Ogata, Slotine
3	Phase plane analysis	Types of Equilibrium points Phase portrait, trajectories for linear systems in phase plane, graphical methods of plotting		Ogata
4	Phase plane analysis	Time response from phase plane plot. Trajectories for nonlinear systems in phase plane, piece-wise linear approach		Ogata
5	Sliding mode control	Optimal switching line in piece-wise linear approach, sliding surface and condition for sliding, SMC for linear systems, Order reduction in SMC.		
6	Sliding mode control	SMC for general NL Systems, SMC synthesis, Equivalent control approach		DeCarlo
7	Mid Exam			
8	Nonlinearity in the Sector & Lure's problem	Definition of NL in the sector, Saturation & Deadzone, Lure's problem formulation		DeCarlo
9	Anti-windup Systems	Wind-up phenomenon and compensation, AW for SISO linear systems		Lecture Notes

10	Anti-windup Systems	AW for MIMO linear systems, directionality compensation (DC), multivariable algebraic loop (MV AL), DC-MV AL equivalence		Lecture Notes
11	Model predictive control	Input constarined Linear Systems, LQ discrete time control, MPC approach & principle		Lecture Notes
12	Model predictive control	MPC regulator systems & MPC for tracking		Lecture Notes
13	Kalman-Yakubovich-Popov Lemma and Linear Matrix Inequalities (LMIs)	AW systems and MPC as Lure's problem, LMIs formulation for Lure's problem		Khalil
14	Lypunov stability theory and applications	Types of stability, Lyapunov stability analisis		Slotine, Khalil
15	Feedback linearization	Nonlinear control synthesis via feedback linearization		Slotine

Silabus dan Satuan Acara Pengajaran (SAP) EL5212

Kode Matakuliah: EL5212	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Robotika Lanjut
	Advance Robotics
Silabus Ringkas	1)Pendahuluan.; 2)Robot Manipulator : kendali joint tunggal/bebas 3) Robot Manipulator : Kendali Multivariable 4)Kendali Gaya 5)Sistem kendali robot berbasis visual 6) Robot bergerak Autonomi 7) Robot Dua kaki (Bipedal) 8) Sistem Multi-robot
	1)Introduction.; 2)Robot Manipulator : Independent/Single Joint Control 3) Robot Manipulator : Multivariable Control 4)Force control 5)Vision-based Robot Control/Visual Servoing 6) Autonomous Mobile Robot 7) Bipedal Robot 8) Multi-robot System
Silabus Lengkap	1)Pendahukuan.: sistem perpindahan posisi, model kinematika, model dinamika, perencanaan trayektori/pergerakan robot, sensor robot; 2)Robot Manipulator : Kendali joint tunggal/bebas : dinamika aktuator, penjejakan set point : kendali PID, kendali umpan-maju, kendali computed torque, dinamika rangkaian penggerakan, Desain dengan State space 3) Robot Manipulator : Kendali Multivariable : Kendali PID, Kendali Dinamika balik, KEndali pergerakan adaptive dan kokoh 4)Kendali Gaya : Kerangka Koordinat dan kendalanya, Model jaringan dan impedansi, Dinamika Ruang tugas dan kendali 5)Kendali Robot berbasis visual /Visual Servoing: Computer Vision, Position-Based Visual Servoing, Image-Based Visual Servoing, Hybrid Visual Servoing : 2,5 D Visual Servoing, Beberapa jenis Visual servoing yang lainnya 6)Robot bergerak Otonomi : Persepsi, Lokalisasi, Perencanaan gerak dan kendali gerak 7)Robot 2 kaki (Bipedal) : overview dari kaki banyak sampai ke kaki dua , Sistem gaya melangkah (Gait) : metoda berjalan dan berlari, Kestabilan : statik dand dinamik , Zero Moment Point 8) Sistem Multi-robot : overview, Pemodelan , swarm, Multi-robot SLAM, Pendekatan berinspirasi biologi
	1)Introduction. : locomotion system, kinematics model, dynamic model, robot trajectory/motion planning, sensors for robot, ; 2)Robot Manipulator : Independent/Single Joint Control : actuator dynamic, set point tracking : PID control, Feedforward control, computed torque control, Drive train dynamics. State space design 3) Robot Manipulator : Multivariable Control : PID control, Inverse dynamic control, Robust and adaptive motion control 4)Force control: coordinates frame and constraints, Networks model and impedance, Task space dynamic and control 5)Vision-based Robot Control/Visual Servoing: Computer Vision, Position-Based Visual Servoing, Image-Based Visual Servoing, Hybrid Visual Servoing : 2,5 D Visual Servoing, other types of Visual Servoing 6)Autonomous Mobile Robot : Perception, Localization, Planning and navigation, motion control 7)Bipedal Robot : overview multiple leg robot to bipedal robot , Gait system : walking and running methodology, Stability : static and dynamic , Zero Moment Point 8) Multi-robot System : overview, Modeling, SWARM, Multi-robot SLAM, Bio-inspired approach :
Luaran (Outcomes)	1)Memahami dan mengingat berbagai komponen (fisik maupun pemodelan) dalam sistem robot dan kaitannya satu sama lain 2)Memahami beberapa metododologi kendali robot manipulator dengan pendekatan joint tunggal 3)Mampu menghitung dan melakukan simulasi kendali PID pada robot manipulator dengan pendekatan joint tunggal 4)Memahami beberapa metododologi kendali robot manipulator dengan pendekatan multivariable 5)Mampu menghitung dan melakukan simulasi pada salah satu metoda dalam kendali pergerakan adaptif dan kokoh 6)Memahami metoda kendali gaya pada robot manipulator dan melakukan simulasi robot dengan kendali gaya 7)Memahami prinsip sistem kendali berbasis visual dan mampu menurunkan model Jacobian Citra/matrik interaksi 8)Memahami prinsip lokalisasi, Pemetaan, perencanaan gerak dan navigasi, dan kendali pergerakan robot bergerak tipe roda 9)Memahami prinsip gait dan kestabilan, dan metoda kendali dengan pendekatan Zero Moment Point 10)Memahami trend dan perkembangan Multi-robot
Matakuliah Terkait	
Kegiatan Penunjang	Praktikum
Pustaka	Mark W.Spong, Seth Huchinson, M.Vidyasagar. Robot Modeling and Control, John Wiley and Sons, 2005 [Pustaka Utama 1]
	K.S. FU, R.C. Gonzales, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence, Mc.GrawHill, 1997 [Pustaka Utama 2]
	Roland S., Illah R.N., David S., Autonomous Mobile Robot, MIT Press, 2011 [Pustaka Utama 3]
	Eric R. Westervelt, Jessy W. Grizzle,. Christine Chevallereau, Jun Ho Choi, and Benjamin Morris. Feedback Control of. Dynamic Bipedal Robot. Locomotion, CRC Press, 2007 [Pustaka Utama 4]
	T. Yasuda, K. Ohkura. Multirobot Systems Trends and Development, Intech, 2011 [Pustaka pendukung 1]
Panduan Penilaian	UTS, UAS, Tugas dan Eksperimen
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction	locomotion system, kinematics model, dynamic model	Memahami prinsip dasar perpindahan posisi, komponen sistem robot, model kinematik dan model dinamika pada robot manipulator	Bab 1-3 ,6 [pustaka utama 1] Bab 1-3 [pustaka utama 2] Majalah Spectrum terkini
2	Introduction	robot trajectory/motion planning, sensors for robot	Memahami prinsip perencanaan gerak berbasis joint dan task pada robot	Bab 4-5 [pustaka utama 1] Bab 4,6 [pustaka utama 2]

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			manipulator, mengenal berbagai jenis sensor pada robot	
3	Robot Manipulator : Independent/Single Joint Control	actuator dynamic, set point tracking : PID control, Feedforward control,	Memahami prinsip kendali PID pada joint tunggal dan mampu melakukan simulasi pergerakan	Bab 7 [pustaka utama 1] Bab 5 [pustaka utama 2]
4	Robot Manipulator : Independent/Single Joint Control	computed torque control, Drive train dynamics, State space design	Memahami prinsip kendali computer-torque pada joint tunggal dan mampu menurunkan model dengan pendekatan state space	Bab 7 [pustaka utama 1] Bab 5 [pustaka utama 2]
5	Robot Manipulator : Multivariable Control	PID control, Inverse dynamic control	Memahami prinsip kendali Multivariable pada robot manipulator dan mampu melakukan simulasi pergerakan	Bab 8 [pustaka utama 1]
6	Robot Manipulator : Multivariable Control	Robust and adaptive motion control	Memahami prinsip kendali Adaptif pada system robot manipulator dan mampu menurunkan model	Bab 8 [pustaka utama 1]
7	Force control	coordinates frame and constraints, Networks model and impedance	Memahami prinsip kerangka koordinat pada robot manipulator, model jaringan dan impedansi	Bab 9 [pustaka utama 1]
8	Force control	Task space dynamic and control	Memahami prinsip kendali gaya dalam ruang tugas	Bab 9 [pustaka utama 1]
9	Vision-based Robot Control/Visual Servoing	Computer Vision, Position-Based Visual Servoing, Image-Based Visual Servoing,	Memahami konsep computer vision dalam penafsiran citra, dan menunjukkan perbedaan antara PBVS dan IBVS	Bab 11-12 [pustaka utama 1] Bab 7-8 [pustaka utama 2]
10	Vision-based Robot Control/Visual Servoing	Hybrid Visual Servoing : 2,5 D, Visual Servoing, other types of Visual Servoing	Memahami prinsip Kendali IBVS/PBVS, 2,5 D dan tipe kendali VS yang lain	Bab 12 [pustaka utama 1]
11	Autonomous Mobile Robot	Perception, Localization, Planning and navigation, motion control	Memahami prinsip persepsi, lokalisasi, perencanaan gerak dan navigasi robot otonomi	Bab 1-5 [pustaka utama 3]
12	Bipedal Robot:	overview multiple leg robot to bipedal robot , Gait system : walking and running methodology	Memahami mekanisme gerak (gaits) robot bipedal	Bab 1-3 [pustaka utama 4]
13	Bipedal Robot:	Stability : static and dynamic , Zero Moment Point	Memahami prinsip kendali dengan pendekatan ZMP	Bab 4-6 [pustaka utama 4]
14	Multi-robot System	overview, Modeling, SWARM	Memahami prinsip koordinasi dan kolaborasi pada sistem multirobot	Section 1 [pustaka pendukung 1]
15	Multi-robot System	Multi-robot SLAM, Bio-inspired approach	Memahami beberapa metoda dalam system multirobot	Section 2 [pustaka pendukung 1]

Silabus dan Satuan Acara Pengajaran (SAP) EL5213

Kode Matakuliah: EL5213	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Desain Sistem Mekatronika
	Design of Mechatronics System
Silabus Ringkas	1) Pengantar Rekayasa Sistem 2) Pendekatan-pendekatan desain dalam sistem mekatronika 3)Sistem Antarmuka, instrumentasi dan sistem kendali 4)pengendali berbasis computer/mikrokontroller 5)analisis fault 6)Pengenalan teknologi mikro/nano
	1) Introduction to System Engineering, 2)Mechatronics design approach 3)System interfacing, Instrumentation and Control system 4) computer/microprocessor based controller 5) fault analysis of mechatronics system, 6)introduction to micro/nano technology
Silabus Lengkap	1) Pengantar Rekayasa Sistem: definisi, rekayasa sistem sebagai aktivitas manusia, analisis stake holder dan persyaratan, inovasi dalam sistem rekayasa, konsep seleksi, verifikasi dan validasi desain, manajemen siklus-hidup.; 2) pendekatan desain pada sistem mekatronika : • Pengenalan Sistem Mekatronika: Definisi Dasar • Elemen Kunci Mekatronika • Perspektif Sejarah / Pengembangan dan Definisi Sistem mekatronika• Fungsi sistem Mekatronika • Cara Integrasi • Sistem Pengolahan Informasi (Arsitektur Dasar dan tawar menawar HW/SW) • Prosedur Desain Concurrent untuk Sistem Mekatronik.; 3) Sistem Antarmuka, Instrumentasi, dan Sistem Kendali : Sinyal masukan ke Sistem Mekatronika • Sinyal keluaran dari Sistem Mekatronika • pengkondisi Sinyal • kendali Microprocessor • kendali input-Output pada microprosesor • peranti lunak kendali • Pengujian dan Instrumentasi.; 4) Pengendali berbasis komputer/Mikroprosesor dan Mikroelektronika: Pengantar Microelectronics • Logika Digital • Programmable Logic Controllers.; 5) Analisis Fault pada sistem mekatronika: • Pendahuluan • Tool yang digunakan untuk analisis fault dan Keandalan • Analisis fault (Kegagalan) sistem Mekatronika • Teknik Deteksi fault Cerdas • Permasalahan dalam Deteksi Fault Cerdas • Contoh Sistem Mekatronika : Manipulators Paralel/Mesin.; 6) Pengantar Teknologi Mikro dan Nano: microactuators • microsensor, nanomachine, Arah Baru pengembangan desain di skala nano-Micro-mini dalam sistem mekatronika
	1) Introduction to System Engineering : definition, system engineering as human activity, stake holder analysis and requirement definition, innovation in System Engineering, selection concept, design verification and validation, lifecycle management 2) Mechatronic design approach: •Introduction of Mechatronics system : Basic Definitions • Key Elements of Mechatronics • Historical Perspective/Development and Definition of Mechatronic Systems • Functions of Mechatronic Systems • Ways of Integration • Information Processing Systems (Basic Architecture and HW/SW Trade-offs) • Concurrent Design Procedure for Mechatronic Systems 3) System Interfacing, Instrumentation, and Control Systems : • Input Signals of a Mechatronic System • Output Signals of a Mechatronic System • Signal Conditioning • Microprocessor Control • Microprocessor Input–Output Control • Software Control • Testing and Instrumentation 4) computer/Microprocessor-Based Controllers and Microelectronics: Introduction to Microelectronics • Digital Logic • Programmable Logic Controllers 5)Fault Analysis in Mechatronic Systems : • Introduction • Tools Used for Failure/Reliability Analysis • Failure Analysis of Mechatronic Systems • Intelligent Fault Detection Techniques • Problems in Intelligent Fault Detection • Example Mechatronic System: Parallel Manipulators/Machine Tools 6) An Introduction to Micro- and Nanotechnology : Microactuators • Microsensors • Nanomachines : New Directions in Nano-, Micro-, and Mini-Scale Electromechanical Systems Design
Luaran (Outcomes)	1) Memahami proses dan tahapan yang perlu dilakukan dalam desain system rekayasa dan mampu mengimplementasikan dalam sebuah studi kasus : Mobil Listrik 2) Memahami prinsip pengintegrasian, desain serentak dan tawar menawar s/w dan h/w (h/w - s/w -co-design) dalam desain sistem mekatronika dan mampu mengimplemtasikan dalam sebuah studi kasus 3) memahami peran sensor-aktuator, sistem kendali, sistem komputer/mikroprosesor, peranti lunak dan sistem antarmuka dalam sistem mekatronik dan mampu mengimplementasuikan dalam sebuah studi kasus 4) Memahami konsep Analisis kegagalan dan mengimplementasikan dalam sebuah studi kasus 5) memahami perkembangan temologi mikro-nano dalam system mekatronika
Matakuliah Terkait	
Kegiatan Penunjang	Praktikum
Pustaka	Andrew P.Sage, William B. Rouse, System Engineering and managements, John Wiley and Sons, 2009 [Pustaka utama 1]
	Robert H. Bishop, Mechatronic Handbook, CRC Press, 2009 [Pustaka utama 2]
	W. Bolton, Mechatronics : a multidisciplanary approach (4 th edition), Pearson-Prentice Hall, 2008 [pustaka utama 3]
Panduan Penilaian	Tugas Kelompok (1/2/3) , Praktikum
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to System Engineering	definition, system engineering as human activity, stake holder analysis and requirement definition	1) Memahami definisi rekayasa system dan proses-proses yang ada di dalamnya. 2)Mampu menuliskan faktor3 yang terlibat dalam aktifitas manusia 3) mempu menguraikan kebutuhan dari stake holder dalam suatu kasus (mobil listrik)	Bab 1-2 [Pustaka utama 1]
2	Introduction to System	innovation in System	1)memahami aspek inovasi dalam	Bab 3-4 [Pustaka utama 1]

	Engineering	Engineering, selection concept	rekayasa system 2)memahami prinsip dasar pemilihan 3)mampu menjelaskan aspek inovasi dan konsep yang dipilih dalam suatu studi kasus	
3	Introduction to System Engineering	design verification and validation, lifecycle management	1)Memahami prinsip verifikasi dan validasi perancangan 2)memahami prinsip pengelolaan siklus-hidup	Bab 5-9 [Pustaka utama 1]
4	Mechatronic design approach:	•Introduction of Mechatronics system : Definition of Mechatronic Systems • Key Elements of Mechatronics • Historical Perspective/Development	Memahami definisi system mekatronik dan mampu menyebutkan elemen utama dalam sistem mekatronik pada suatu studi kasus	Section 1: Bab1 -5 [Pustaka utama 2]
5	Mechatronic design approach:	• Functions of Mechatronic Systems • Ways of Integration • Information Processing Systems (Basic Architecture and HW/SW Trade-offs)	Mampu mengungkapkan fungsi yang detail dalam system mekatronika, mengintegrasikan perangkat lunak perangkat keras sistem	Section 1: Bab 1-5 [Pustaka utama 2]
6	Mechatronic design approach:	• Concurrent Design Procedure for Mechatronic Systems	mampu menguraikan prosedur konkuren dalam sebuah studi kasus sistem mekatronik	Section 1: Bab 1-5 [Pustaka utama 2]
7	System Interfacing, Instrumentation, and Control Systems :	• Input Signals of a Mechatronic System • Output Signals of a Mechatronic System •	Mampu menjelaskan sinyal masukan dan keluaran dalam sebuah model blok diagram dan Bondgraph	Section 2, Section 3 [Pustaka utama 2]
8	System Interfacing, Instrumentation, and Control Systems :	Signal Conditioning • Microprocessor Control • Microprocessor Input–Output Control	Mampu mendesain perangkat pengkondisi sinyal yang dibutuhkan untuk interafacing dengan perangkat microcontroller atau komputer	Section 2, Section 3 [Pustaka utama 2]
9	System Interfacing, Instrumentation, and Control Systems :	Software Control • Testing and Instrumentation	Mampu mendesain peranti lunak untuk kebutuhan komunikasi data antara prosesor digital dengan sensor	Section 4 [Pustaka utama 2]
10	computer/Microprocessor-Based Controllers	Port, register, timer/counter, adressing	Mampu mendesain algoritma kendali sebuah proses dalam sebuah studi kasus	Section 5 [Pustaka utama 2]
11	computer/Microprocessor-Based Controllers	Programmable Logic Controllers	Mampu mendesain algoritma dalam PLC	Section 5 [Pustaka utama 2]
12	Fault Analysis in Mechatronic Systems	: • Introduction • Tools Used for Failure/Reliability Analysis • Failure Analysis of Mechatronic Systems • Intelligent Fault Detection Techniques •	Memahami konsep analisis fault	Section 5 [Pustaka utama 2]
13	Fault Analysis in Mechatronic Systems	Problems in Intelligent Fault Detection • Example Mechatronic System: Parallel Manipulators/Machine Tools	Memapu menerapkan analisis fault pada sistem mekatronika	Section 5 [Pustaka utama 2]
14	An Introduction to Micro- and Nanotechnology	Microactuators, Microsensors	Memahami proses pembuatan sensor dan actuator nernasis teknologi miro/nano	Section 2 [Pustaka utama 2]
15	An Introduction to Micro- and Nanotechnology	Nanomachines, New Directions in Nano-, Micro-, and Mini-Scale Electromechanical Systems Design	Memahami arah pengembangan teknologi nano/mikro yang terkait dengan sistem mekatronika	Section 2 [Pustaka utama 2]

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Silabus dan Satuan Acara Pengajaran (SAP) EL5214

Kode Matakuliah: EL5214	*Bobot sks: 3*	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Sistem dan Kendali Embedded
	Embedded Control Systems

Silabus Ringkas	

Silabus Lengkap	Part I: Embedded systems overview; design challenges: optimization design metrics; processor, IC, and design technologies; Custom single purpose processors: hardware; combinational & sequential logic; custom single-purpose processor design; RT-level processor design; optimizing single-purpose processor design; General purpose processors; application-specific instruction-set processors (ASIPs); general purpose processor design; standard single-purpose processors; memory; interfacing; digital camera example; state machine & concurrent processes; real-time systems; control systems application. Part II: Introduction, digital control system concept; sampling process, signal measurement process; discrete time control analysis using conventional method (Z-transform); discrete-time control analysis using state space model; controller designs: classical and modern approaches; controllability, observability, stability; control implementation: hardware & software; digital controller designs: discrete & continuous time methods

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	F.Vahid & T. Givargis, Embedded System Design: A Unified Hardware Software Introduction, John Wiley & Sons, 2002.
	D. Ibrahim, Microcontroller Based Applied Digital Control, John Wiley & Sons, 2007.
	T.Wescott, Applied Control Theory for Embedded Systems, Elsevier-Newnes, 2006.
	S.Bennet, Real-Time Computer Control, Prentice Hall, 1994

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Embedded systems overview	Design challenges: optimizing design metrics; processor, IC, and design technologies		
2	Custom single purpose processors	RT-level processor design; optimizing single-purpose processor design;		
3	Standard single-purpose	General purpose processor design, processors, memory, interfacing		
4	General purpose processors & ASIPs	General purpose processor design, Application-specific instruction-set processors		
5	Digital camera example			
6	State machine & concurrent processes			
7	State machine & concurrent processes			
8	Mid Exam			
9	Real-time systems			
10	Real-time systems			
11	Digital control system	The concept; sampling process, signal measurement process		
12	Discrete time control analysis	analysis using conventional method (Z-transform)		

13	Controller designs	classical and modern approaches; controllability, observability, stability		
14	Controller implementation			
15	Digital controller designs	discrete & continuous time methods		

Silabus dan Satuan Acara Pengajaran (SAP) EL5215

Kode Matakuliah: EL5215	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Keamanan Perangkat Lunak
	Secure Software
Silabus Ringkas	This course will discuss the practice of software security, focusing in particular on some common software security risks, including buffer overflows, race conditions and random number generation, and on the identification of potential threats and vulnerabilities early in the design cycle. The emphasis is on methodologies and tools for identifying and eliminating security vulnerabilities, techniques to prove the absence of vulnerabilities, and ways to avoid security holes in new software and on essential guidelines for building secure software and to integrate analysis and risk management throughout the software life cycle.
Silabus Lengkap	**Introduction:** introduction to software security. **Software Security Fundamentals:** The security problem in software, pillars of software security, rise of software security. **Risk Management Framework (RMF):** Risk activity stages, measuring and reporting risks. **Touchpoints of Software Security:** Introduction, code review tools, architectural risk analysis, software penetration testing, risk-based security testing, abuse cases, security operations. **Software Security Grows up:** enterprise software security measures, open source applications, secure development lifecycle, building knowledge of software security, taxonomy of coding errors
Luaran (Outcomes)	1. Understand the importance of secure software systems. 2. Identify major software security issues. 3. Apply risk management framework stages. 4. Assess software security using code review tools and risk-based security testing.
Matakuliah Terkait	Information Security Management — Prasayarat Introduction to Cryptography — Prasyarat
Kegiatan Penunjang	
Pustaka	The Security Development Lifecycle (Paperback) Michael Howard, Steve Lipner Microsoft Press; Pap/Cdr edition (June 28, 2006)
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction:** introduction to software and Database security.			
2	**Software Security Fundamentals:** The security problem in software, pillars of software security, rise of software security.			
3	**Risk Management Framework (RMF):** Risk activity stages, measuring and reporting risks.			
4	**Touchpoints of Software Security:** Introduction, code review tools, architectural risk analysis, software penetration testing,			
5	**Touchpoints of Software Security::** risk-based security testing, abuse cases, security operations.			
6	**Software Security Grows up:** enterprise software security measures, open source applications, secure development lifecycle,			
7	**Software Security Grows up:** building knowledge of			

	software security, taxonomy of coding errors.			
8				

Silabus dan Satuan Acara Pengajaran (SAP) EL5216

Kode Matakuliah: EL5216	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Manajemen Resiko Keamanan Informasi			
	Information Security Risk Management			
Silabus Ringkas	This course is designed so that the student can learn to identify and manage risks through the development, implementation and maintenance of appropriate information systems (IS) controls. This course approaches information security as a management problem, where the organization has to to decide on how much to spend on information security and how, and trade off information security risks other risks. Students will learn analytical tools for calculating the costs and benefits of investment security decisions, and how to implement IS control.			
Silabus Lengkap	This course focuses on: • Risk identification, assessment and evaluation • Risk response • Risk monitoring • IS control design and implementation • IS control monitoring and maintenance			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	[1] Alan Calder and Steve G Watkins, Information Security Risk Management for ISO27001 / ISO27002, IT Governance Ltd, 2010			
	[2] Evan Wheele, Security Risk Management: Building an Information Security Risk Management Program from the Ground Up, Syngress, 2011			
	[3] Mark Talabis and Jason Martin, Information Security Risk Assessment Toolkit: Practical Assessments through Data Collection and Data Analysis, Syngress, 2012			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Risk Identification**			
2	**Risk Assessment**			
3	**Risk Evaluation**			
4	**Risk Response**			
5	**Risk Monitoring**			
6	**Information Systems Control Design**			
7	**Information Systems Control Implementation**			
8	**Information Systems Control Monitoring**			
9	**Information Systems Control Maintenance**			
10				

Silabus dan Satuan Acara Pengajaran (SAP) EL5217

Kode Matakuliah: EL5217	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Audit Keamanan Informasi
	Information Security Audit
Silabus Ringkas	In this course, you will perform evaluations of organizational policies, procedures, and processes to ensure that an organization's information systems align with overall business goals and objectives. This course presents the fundamental concepts of the IT-security audit and control process that is being conducted in a plethora of environments, including government, the financial industry, and the healthcare industry. The goal of this course is to enable the students to structure and perform audits based on the specifications of Sarbanes-Oxley, HIPAA, and FISMA audit programs. Covers all the CISA certification requirements in depth.
Silabus Lengkap	The field of information systems is growing and changing at an increasingly fast pace. Organizations are investing in and relying on a secure and efficient IT infrastructure to maintain business and meet business goals and objectives. Information systems auditing plays a crucial role in developing and maintaining this business environment. The information systems auditor is responsible for evaluating security in all aspects of the infrastructure and to also guide business leaders in maintaining a secure organization. This course can enable you to evaluate the security and controls of the organization's business structure and governance methods; the policies, procedures, and guidelines used; and the overall security of the business environment. The intended audience for this course is information systems security professionals and internal review auditors and other individuals who have an interest in aspects of information systems audit, controls, and security.
Luaran (Outcomes)	
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Robert Johnson & Mark Merkow, Security Policies and Implementation Issues (Information Systems Security & Assurance), Jones & Bartlett Learning; 1 edition, 2010
Panduan Penilaian	Assignments, 20% / Presentation, 5%/ Quizzes 15% 1. Audit and Risk Assessment Exercise 2. Audit of Policies and Procedures. Final Examination, 60%
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	The Information Systems Audit Process	Lesson Introduction ISACA Information Systems Auditing Standards and Guidelines Develop and Implement an Information Systems Audit Strategy Plan an Audit Conduct an Audit		
2	The Information Systems Audit Process	The Evidence Lifecycle Communicate Issues, Risks, and Audit Results Support the Implementation of Risk Management and Control Practices		
3	IT Governance	Lesson Introduction Evaluate the Effectiveness of IT Governance Evaluate the IT Organizational Structure Evaluate the IT Strategy		

		Evaluate IT Policies, Standards, and Procedures for Compliance Ensure Organizational Compliance		
4	IT Governance	IT Resource Investment, Use, and Allocation Practices Evaluate IT Contracting Strategies and Policies Evaluate Risk Management Practices Performance Monitoring and Assurance Practices		
5	Systems and Infrastructure Lifecycle Management	Lesson Introduction Determine the Business Case for Change Evaluate Project Management Frameworks and Governance Practices Perform Periodic Project Reviews		
6	Systems and Infrastructure Lifecycle Management	Evaluate Control Mechanisms for Systems Evaluate Development and Testing Processes Evaluate Implementation Readiness Evaluate a System Migration		
7	Systems and Infrastructure Lifecycle Maintenance	Lesson Introduction Perform a Post-Implementation System Review Perform Periodic System Reviews		
8	Systems and Infrastructure Lifecycle Maintenance	Evaluate the Maintenance Process Evaluate the Disposal Process		
9	IT Service Delivery and Support	Lesson Introduction Evaluate Service Level Management Practices Evaluate Operations Management Evaluate Data Administration Practices Evaluate the Use of Capacity and Performance Monitoring Methods		
10	IT Service Delivery and Support	Evaluate Change, Configuration, and Release Management Practices Evaluate Problem and Incident Management Practices Evaluate the Functionality of the IT Infrastructure		
11	Protection of Information Assets	Lesson Introduction Information Security Design Encryption Basics Evaluate the Design, Implementation, and Monitoring of Logical Access Controls Evaluate the Design, Implementation, and Monitoring of Physical Access Controls		

12	Protection of Information Assets	Evaluate the Design, Implementation, and Monitoring of Environmental Controls Evaluate Network Infrastructure Security Evaluate the Confidential Information Processes and Procedures		
13	Business Continuity and Disaster Recovery	Lesson Introduction Evaluate the Adequacy of Backup and Restore		
14	Business Continuity and Disaster Recovery	Evaluate the BCP and DRP		

Silabus dan Satuan Acara Pengajaran (SAP) EL5218

Kode Matakuliah: EL5218	*Bobot sks:* 3	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Tata Kelola dan Assurance Keamanan Informasi
	Information Security Assurance and Governance
Silabus Ringkas	This course is designed to enable candidates to understand the roles, responsibilities and various focus areas of IT governance. The course is aimed at IT and business professionals who hold substantial positions in management, advisory or assurance related to the governance of enterprise IT.
Silabus Lengkap	Specifically developed to gain experience in the following areas: • IT Governance Framework • Strategic Alignment • Value Delivery • Risk Management • Resource Management • Performance Measurement
Luaran (Outcomes)	
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Krag Brotby, Information Security Governance: A Practical Development and Implementation Approach, Wiley Series in Systems Engineering and Management, 2009 S.H. von Solms, Information Security Governance, Springer; 1st Edition. 2nd Printing. 2008 edition
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**The IT Governance Framework Overview**			
2	**The IT Governance Framework Content**			
3	**Strategic Alignment Overview**			
4	**Strategic Alignment Content**			
5	**Value Delivery Overview**			
6	**Value Delivery Content**			
7	**Risk Management Overview**			
8	**Risk Management Content**			
9	**Resource Management Overview**			
10	**Resource Management Content**			
11	**Performance Management Overview**			
12	**Performance Management Content**			
13				
14				

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Silabus dan Satuan Acara Pengajaran (SAP) EL5219

Kode Matakuliah: EL5219	Bobot sks: 2	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Perancangan Sistem Biomedika Lanjut			
	Advanced Biomedical System Design			
Silabus Ringkas	Pendahuluan. Tahap-tahap perancangan sistem biomedika, penggunaan perangkat lunak bantu perancangan, pengembangan perangkat keras dan proses fabrikasi. Kriteria perancangan, proses perancangan sistem biomedika, peraturan perijinan. studi kasus perancangan sistem biomedika.			
Silabus Lengkap	Pendahuluan: Kuliah ini bertujuan memberikan kemampuan merancang dan merealisasikan suatu sistem biomedika untuk lingkungan klinik, laboratorium atau industri. Tahap-tahap perancangan sistem biomedika, studi kasus perancangan sistem, masalah teknologi, masalah organisasi, penggunaan perangkat lunak bantu perancangan, pengembangan perangkat keras dan proses fabrikasi serta masalah-masalah terkait. Sistem biomedika secara umum, kriteria perancangan, proses perancangan sistem biomedika, peraturan perijinan terkait. Sensor, transduser, penguat & pemroses sinyal. Alat-alat bantu diagnosa, therapi dan prothesa. Sejumlah contoh dan studi kasus perancangan.			
Luaran (Outcomes)	Mahasiswa mampu merancang dan merealisasikan suatu sistem biomedika untuk lingkungan klinik, laboratorium atau industri			
Matakuliah Terkait	EL5100 Teknik Biomedika			
Kegiatan Penunjang				
Pustaka	Advanced Methodical Design. van der Houwen, Verkerke. (*Pustaka utama*)			
	Biomedical Instruments – Application & Design. John G.Webster. John Wiley, 1998 (*Pustaka alternatif*)			
	Introduction to Biomedical Equipment Technology. Carr & Brown. Prentice-Hall, 2001 (*Pustaka pendukung*)			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pendahuluan			
2	Tahap-tahap perancangan sistem biomedika,			
3	studi kasus perancangan sistem,			
4	masalah teknologi,			
5	masalah organisasi,			
6	penggunaan perangkat lunak bantu perancangan,			
7	pengembangan perangkat keras dan proses fabrikasi serta masalah-masalah terkait.			
8	Sistem biomedika secara umum,			
9	kriteria perancangan,			
10	proses perancangan sistem biomedika,			
11	peraturan perijinan terkait.			
12	Sensor, transduser, penguat & pemroses sinyal.			
13	Alat-alat bantu diagnosa, therapi dan prothesa.			
14	Sejumlah contoh dan studi kasus perancangan.			
15	Tugas Besar			

Silabus dan Satuan Acara Pengajaran (SAP) EL5220

Kode Matakuliah: EL5220	*Bobot sks:* 2	*Semester:* Genap	*KK / Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Wajib Jalur

Nama Matakuliah	Fenomena Transpor dalam Teknik Biomedika
	Transport Phenomena in Biomedical Engineering
Silabus Ringkas	Deskripsi kuantitatif transportasi momentum (aliran viskos) dan transportasi massa (konveksi dan difusi) dalam sistem hidup. Penerapan metode rekayasa untuk permodelan dan pengukuran aspek-aspek dalam teknik biomedika.
	The quantitative description of momentum transport (viscous flow) and mass transport (convection and diffusion) in living systems. Application of engineering methods to model and quantify aspects of biomedical engineering.
Silabus Lengkap	Perpindahan energi, massa dan momentum sangat penting untuk sistem biologi. Dalam kuliah ini akan dikembangkan deskripsi kuantitatif proses transportasi dalam system biologi yang berskala spasial dari yang kecil ke besar. Kita akan belajar bagaimana menerapkan prinsip-prinsip transportasi massa dan panas ke sistem biologis, untuk memecahkan masalah yang berkaitan dengan perpindahan massa dan panas dan menggunakan alat komputasi untuk memecahkan masalah.
	The transport of energy, mass and momentum are essential to biological system. In this course we will develop a quantitative description of transport processes from small to large spatial scale of biological systems. We will learn how to apply mass and heat transport principles to biological systems, to solve problems related to mass and heat transfer and to use computational tools to solve problem.
Luaran (Outcomes)	1. Memahami model matematis proses transportasi massa dan energi. 2. Mampu menggunakan model transportasi massa dan energi dalam sistem biologis. 3. Mampu menggunakan metode komputasi untuk penyelesaikan masalah transportasi dalam sistem biologis berskala besar.
Matakuliah Terkait	Matematika Lanjut: Persamaan differensial, dan Aljabar Linier	Prasyarat
	Pengantar Teknik Biomedika	boleh bersamaan
Kegiatan Penunjang	
Pustaka	1. Basic Transport Phenomena in Biomedical Engineering, second edition, by Ronald L. Fournier. (*Pustaka utama*)
	2. Transport Phenomena, second edition, by BSL (*pendukung*)
	3. Transport Phenomena in Biological Systems, first edition, by GA Truskey et. al., (*pendukung*)
Panduan Penilaian	Tugas 20%, Proyek Akhir 25%, UTS 25%, UAS 30%
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pengantar Kuliah	Pengenalan mata kuliah Review unit dan dimensi Konservasi massa dan momentum		Bab 1 [1]
2	Permodelan transportasi massa dan energi	Transportasi: Momentum, Energi, Mass Solution Persamaan Transpor		Bab 2 [1]
3	Permodelan transportasi massa dan energy (2)	Latihan menyelesaikan persamaan transpor		
4	Solusi model transpor dengan metode komputasi	Menggunakan program opensource FreeFem++		
5	Sifat fisika cairan tubuh dan membran sel			Bab 3 [1]
6	Fisika Aliran Darah	Reologi darah		Bab 4 [1]
7	Fisika Aliran Darah (2)	Aliran darah		Bab 4 [1]
8	Fisika Aliran Darah (3)	Teori *Boundary layer* Pipa kapiler		Bab 4 [1]
9	UTS			
10	Transportasi larutan dalam sistem biologi	Diffusi larutan Transportasi larutan dengan filtrasi kapiler		Bab 5 [1]
11	Transportasi larutan dalam sistem biologi (2)	Permeabilitas larutan Transportasi membran		Bab 5 [1]
12	Transportasi larutan dalam sistem biologi (3)	Transportasi larutan melalui dinding kapiler		Bab 5 [1]
13	Transportasi oksigen dalam sistem biologi			Bab 6 [1]
14	Presentasi Proyek Akhir			
15	UAS			

Silabus dan Contoh Satuan Acara Pengajaran (SAP) EL5221

Kode Matakuliah: EL5221	Bobot sks: 2	Semester: Genap	KK / Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Perancangan Sistem Perangkat Lunak			
Silabus Ringkas				
Silabus Lengkap	An introduction to the practical problems of specifying, designing, and building large, reliable software systems. Students work in teams on projects for real clients. This work includes a feasibility study, requirements analysis, object-oriented design, implementation, testing, and delivery to the client. Additional topics covered in lectures include professionalism, project management, and the legal framework for software development.			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	Sommerville, Ian, Software Engineering, Fifth Edition. Addison-Wesley , 1996.			
	Pfleeger, Shari Lawrence, Software Engineering Theory and Practice, second edition. Prentice-Hall 2001.			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	The Process of Software Development			
2	Feasibility Studies			
3	Legal Aspects of Software Development			
4	Requirements I			
5	Requirements II			
6	Usability			
7	System Architecture			
8	Design I			
9	Design II			
10	Reliability and Performance I			
11	Reliability and Performance II			
12	People			
13	Business Aspects of Software Engineering			
14	Risk			
15				

Silabus dan Satuan Acara Pengajaran (SAP) EL6100 & EL6200

Kode Matakuliah: EL6100 & EL6200	*Bobot sks:* 3	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan
Nama Matakuliah	Kapita Selekta I & II			
	Selected Topics			
Silabus Ringkas				
	This course is intended to cover any other emerging topics that is not currently covered			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	Dependent on topics			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1				
2				
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Silabus dan Satuan Acara Pengajaran (SAP) EL6001

Kode Matakuliah: EL6001	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Kendali Robust
	Robust Control
Silabus Ringkas	History of robust control development; sensitivity & complementary sensitivity in classical control; signal spaces & norms; uncertainty description; LFT (linear fractional transformation) representation; small gain theorem; robustness analysis of multivariable control system; robust performance; robustness analysis using structured singular values μ; Youla parameterization; H∞ control design; industrial applications.
Silabus Lengkap	Introduction to robust control, history of robust control development; sensitivity & complementary sensitivity in classical control; signal spaces & norms; Loop shaping, Robustness of LQG control, Loop transfer recovery, uncertainty description; LFT (linear fractional transformation) representation; small gain theorem; robustness analysis of multivariable control system; robust performance; robustness analysis using structured singular values μ; Youla parameterization; H∞ control design; μ control synthesis, MATLAB Robust Control Toolbox, industrial applications and case studies
Luaran (Outcomes)	To introduce control design methodology which gurantees robustness of feedback closed loop systems under modeling uncertainty
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to robust control; Overview; History			
2	Singular Values, Sensitivity, Complementary Sensitivity in classical control			
3	Signal spaces, Systems and Norms			
4	Loop transformation, Robustness, Robust Stability Analysis			
5	LGQ control			
6	Loop transfer, recovery, and uncertainty			
7	Linear Fractional Transformation representation			
8	Small gain theorem			
9	Robustness analysis of multivariable control system			
10	Robust performance;			
11	Robustness analysis using structured singular values μ;			
12	Youla parameterization;			
13	H∞ control design; μ control synthesis			
14	Application of MATLAB using Robust Control Toolbox			
15	Advanced topics, industrial applications and case studies			

Silabus dan Satuan Acara Pengajaran (SAP) EL6002

Kode Matakuliah: EL6002	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Sistem Kendali Hibrid
	Hybrid Control Systems
Silabus Ringkas	
	Introduction; the development of hybrid control system; hybrid system modeling; hybrid system dynamics; hybrid system properties; stability concept of hybrid system; controllability concept; observability concept; hybrid system analysis; design and implementation
Silabus Lengkap	
	This course provides an introduction to hybrid control. We start by presenting a modeling framework for hybrid systems that combines elements from automata theory and differential equations. The students are then guided through a set of techniques that can be used to analyze and design hybrid control systems. The course also includes an overview of simulation tools for hybrid systems with emphasis on Simulink/Stateflow, SHIFT, and Modelica. In the last part of the course, we cover several fundamental applications of hybrid control. These include the modeling of communication networks, networked control systems, the modeling of bio-chemical reactions, the control of nonlinear systems that cannot be stabilized by continuous control laws, the control of systems with large uncertainty using logic-based supervisors, etc. The course is essentially self-contained and the students are only expected to be familiar with linear algebra and basic differential equations.
Luaran (Outcomes)	
Matakuliah Terkait	Sistem Kendali Linier — Prasyarat
	Sistem kendali Non Linier — Prasyarat
Kegiatan Penunjang	
Pustaka	A. van der Schaft and H. Schumacher. An Introduction to Hybrid Dynamical Systems. Lecture Notes in Control and Information Sciences 251, Springer-Verlag, 2000.
	D. Liberzon. Switching in Systems and Control. Systems & Control: Foundations and Applications series. Birkhauser, Boston, 2003.
	J. Hespanha. Tutorial on Supervisory Control. Lecture Notes for the workshop *Control using Logic and Switching* for the 40th Conf. on Decision and Contr., Orlando, Florida, Dec. 2001.
	J. Hespanha. Chapter Stabilization Through Hybrid Control. In *Encyclopedia of Life Support Systems (EOLSS)*, 2004.
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to Hybrid Control; Overview; History			
2	Review: Continous System Theory			
3	Review: Discrete event systems			
4	Modeling frameworks and systems properties			
5	Modeling and simulation tools			
6	Introduction to verification			
7	Reachability			
8	Safety analysis			
9	Software tools for verification			
10	Stability analysis of hybrid systems			
11	Controller design and synthesis			
12	Stochastic hybrid systems			
13	Case studies			
14	Case studies			
15	Advanced topics			

Silabus dan Satuan Acara Pengajaran (SAP) EL6003

Kode Matakuliah: EL6003	*Bobot sks:* 3	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Teori Game Cerdas
	Intelligent Game Theory
Silabus Ringkas	
Silabus Lengkap	Teori game akan merupakan teori yang semakin penting dalam berbagai bidang, khususnya dalam aplikasi digital media interaktif. Tujuan dari kuliah ini adalah membimbing siswa untuk mengenali, menganalisis, dan problem solving di berbagai bidang aplikasi dari game theory. Mata kuliah ini membutuhkan keterampilan kuantittatif ekstensif
	Topik kuliah dimulai dengan pengambilan keputusan dibawah kondisi ketidakpastian dan profil resiko dari pengguna yang mempengaruhi keluaran keputusan. Kemudian dilanjutkan dengan topic-topik seperti societal efficient outcomes & strategies to avoid the most inefficient outcome, Prisoner's Dilemma. Penggunaan metoda komputasi cerdas dalam pemodelan dan pencarian solusi juga diperkenalkan untuk dapat memberikan pengalaman dan keterampilan pengaplikasian teori game dalm aplikasi digital media interaktif.
	Aplikasi teori game dalam berbagai bidang misalnya topic-topik lingkungan dan pengalokasian sumber daya, Principal-Agent Problem, Desain Mekanisme Lelang dll.
Luaran (Outcomes)	
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Martin J. Osborne, Introduction to Game Theory, Oxford University Press, 2003
	Martin J. Osborne, Rubenstein, A Course in Game Theory, The MIT Press
	Noam Nisam et.al, Algorithmic Game Theory, Cambridge University Press
	Chalkiadakis et. Al., Computational Aspect of Cooperative Game Theory, Morgan & Claypool, 2012
	Lee Alan Dugatkin, Hudson Kern Reeve, Game Theory and Animal Behavior, Oxford University Press
	Roy Gardner, Games for Business and Economics, John Wiley and Sons
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to game theory; Overview			
2	Nash equilibrium; Strategic Game			
3	Cournot's and Bertrand's model of duopoly			
4	Hotelling Model of electoral competition; citizen candidate model			
5	Dominated strategies; iterated elimination of dominated strategies and common rationality			
6	Mixed strategy Nash equilibrium			
7	Sttrategic game with imperfect information; auctions, models of public good provision			
8	Extensive game; subgame perfect equilibrium			
9	Ultimatum game, holdup game			
10	Matching, deferred acceptance algorithm			
11	Repeated game, collusions in repeated duopoly			
12	Job market signaling			
13	Strategic information transmission			
14	Advanced topics			
15	Advanced topics			

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Silabus dan Satuan Acara Pengajaran (SAP) EL6004

Kode Matakuliah: EL6004	*Bobot sks:* 3	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	
	Mixed Reality

Silabus Ringkas	

Silabus Lengkap	
	This course gives students an opportunity to learn about "Mixed Reality" (MR) (and a specific subset of MR referred to as "Augmented Reality" (AR)) as a technology, a human-computer interaction paradigm, a social media, and an electronic medium. MR refers to computer systems that combine virtual content with the physical environment, allowing users to interact with these combined physical/virtual worlds in situ. Students will use the Argon AR Web Browser technology to experiment with MR and AR, with a particular emphasis on the creation of mobile, social AR experiences.

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	No required textbook

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to MR/AR and MR/AR technology			
2	Introduction to MR Experiences			
3	AR Technology with Argon			
4	Hands on with Argon			
5	Mobile Web Programming with Argon			
6	AR Experience Case Studies			
7	AR vision tracking			
8	Design of Outdoor AR Experiences			
9	Design of Outdoor AR Experiences			
10	Flow and Narrative Experiences			
11	Panoramas as Experiences			
12	Liveness and Presence			
13	Liveness and Presence			
14	Advanced topics			
15	Final Presentations			

Silabus dan Satuan Acara Pengajaran (SAP) EL6005

Kode Matakuliah: EL6005	*Bobot sks:* 2	*Semester:* Ganjil / Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Biomekanika
	Biomechanics
Silabus Ringkas	Intro to biomechanics, force vector, moment & torque, statics:analysis of equilibrium system & application to biomechanics, intro to deformable body mechanics, stress/strain, multiaxial deformation&stress analysis, biological tissue mechanical properties, dynamics, linear&angular kinematics, linear&angular kinetics, impulse & momentum
Silabus Lengkap	Intro to biomechanics, force vector, moment & torque, statics:analysis of equilibrium system & application to biomechanics, intro to deformable body mechanics, stress/strain, multiaxial deformation&stress analysis, biological tissue mechanical properties, dynamics, linear&angular kinematics, linear&angular kinetics, impulse & momentum
Luaran (Outcomes)	
Matakuliah Terkait	Teknik Biomedika dan Praktikum Prasyarat
Kegiatan Penunjang	
Pustaka	1. Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation (Ozkaya, Nordin) 2. Joseph D.Bronzino (ed): The Biomedical Engineering Handbook, CRC Press & IEEE Press, 2000 [Section III Biomechanics]
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Intro to biomechanics,			
2	Force vector,			
3	Moment & torque,			
4	Statics:analysis of equilibrium system & application to biomechanics I			
5	Intro to deformable body mechanics,			
6	Stress/strain I			
7	Stress/strain II			
8	Multiaxial deformation&stress analysis I			
9	Multiaxial deformation&stress analysis II			
10	Biological tissue mechanical properties I			
11	Biological tissue mechanical properties II			
12	Dynamics, linear&angular kinematics I			
13	Dynamics, linear&angular kinematics II			
14	linear&angular kinematics I			
15	linear&angular kinematics II			

Silabus dan Satuan Acara Pengajaran (SAP) EL6006

Kode Matakuliah: EL6006	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Gelombang Elektromagnetik & Ultrasonik dalam Biomedika Lanjut			
	Electromagnetic & Ultrasound in Biomedical Engineering			
Silabus Ringkas				
	Anatomical & Physiological Basis of Bioelectromagnetism, Bioelectric Sources/Conductors Modeling, Bioelectromagnetism Measurement Methods, Ultrasound Imaging Systems			
Silabus Lengkap				
	Anatomical & Physiological Basis of Bioelectromagnetism, Bioelectric Sources/Conductors Modeling, Bioelectromagnetism Measurement Methods, Ultrasound Imaging Systems			
Luaran (Outcomes)				
Matakuliah Terkait	EL5100 Teknik Biomedika & Lab.	Prasyarat		
Kegiatan Penunjang				
Pustaka	Diagnostic Ultrasound Imaging: Inside Out (Biomedical Engineering), Thomas L Szabo, 2012 (*pustaka utama*)			
	Bioelectromagnetism: Principles & Applications of Bioelectric & Biomagnetic Fields (Malmivuo, Plonsey) (*Pustaka alternatif*)			
	Joseph D.Bronzino (ed): The Biomedical Engineering Handbook, CRC Press & IEEE Press, 2000 (*pustaka alternatif*)			
Panduan Penilaian	Tugas 20%,Kuis 20 %, UTS 30%, UAS 30 %			
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Anatomical & Physiological Basis of Bioelectromagnetism,			
2	Bioelectric Sources/Conductors Modeling,			
3	Bioelectromagnetism Measurement Methods,			
4	Introduction			
5	Echo Ranging of the Body			
6	Modern Ultrasound Imaging Developments			
7	Enabling Technologies for Ultrasound Imaging			
8	Ultrasound Imaging Safety			
9	Transducer			
10	Piezoelectric Materials			
11	BEAMFORMING			
12	ARRAY BEAMFORMING			
13	WAVE SCATTERING AND IMAGING			
14	SCATTERING FROM TISSUE AND TISSUE CHARACTERIZATION			
15	IMAGING SYSTEMS AND APPLICATIONS			

Silabus dan Satuan Acara Pengajaran (SAP) EL6007

Kode Matakuliah: EL6007	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Sistem Informasi Kesehatan
	Health Information Systems
Silabus Ringkas	Introduction, Back to the future, Structured Data, Biomedical Databases, Semi structured and weakly structured data, Multimedia Data Mining and Knowledge Discovery, Knowledge and Decision, Biomedical Decision Making, Intelligent Information Visualization and Visual Analytics, Biomedical Information Systems and Medical Knowledge Management, Biomedical Data, Methodology for Information Systems.
Silabus Lengkap	Introduction: Computer Science meets Life Sciences, challenges and future directions; Back to the future: Fundamentals of Data, Information and Knowledge; Structured Data: Coding, Classification (ICD, SNOMED, MeSH, UMLS); Biomedical Databases: Acquisition, Storage, Information Retrieval and Use; Semi structured and weakly structured data (structural homologies); Multimedia Data Mining and Knowledge Discovery; Knowledge and Decision: Cognitive Science and Human-Computer Interaction; Biomedical Decision Making: Reasoning and Decision Support; Intelligent Information Visualization and Visual Analytics; Biomedical Information Systems and Medical Knowledge Management; Biomedical Data: Privacy, Safety and Security Methodology for Information Systems: System Design, Usability and Evaluation
Luaran (Outcomes)	
Matakuliah Terkait		
Kegiatan Penunjang	Tugas Besar
Pustaka	Biomedical Informatics, Andreas Holzinger, 2012 (*Pustaka utama*)
	Medical Informatics, van Bemmel, 2004 (*Pustaka alternatif*)
	Joseph D.Bronzino (ed): The Biomedical Engineering Handbook, CRC Press & IEEE Press, 2000 (*Pustaka pendukung*)
Panduan Penilaian	Tugas 20%, Kuis 20 %, UTS 30%, UAS 30 %
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			
2	Back to the future			
3	Structured Data			
4	Biomedical Databases			
5	Semi structured and weakly structured data			
6	Multimedia Data Mining and Knowledge Discovery;			
7	Knowledge and Decision			
8	Biomedical Decision Making I			
9	Biomedical Decision Making II			
10	Intelligent Information Visualization and Visual Analytics I			
11	Intelligent Information Visualization and Visual Analytics II			
12	Biomedical Information Systems and Medical Knowledge Management;			
13	Biomedical Data			
14	Methodology for Information Systems I			
15	Methodology for Information Systems II			

Silabus dan Satuan Acara Pengajaran (SAP) EL6008

Kode Matakuliah: EL6008	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Pencitraan Biomedika			
	Biomedical Imaging			
Silabus Ringkas	Pendahuluan. Pengolahan sinyal, sinyal dua dimensi, sistem pencitraan medis, sistem radiography, *X-ray Computed Tomography* (CT), kedokteran nuklir, *emission computed tomography*, beberapa modalitas pencitraan, *nuclear magnetic resonance*, dan *magnetic resonance imaging*.			
	Introduction. Review of signal processing, two-dimensional signals, medical imaging systems, radiography systems, x-ray computed tomography, nuclear medicine, Emission computed tomography, various imaging modality, nuclear magnetic resonance, and magnetic resonance imaging.			
Silabus Lengkap	Pendahuluan. Pengolahan sinyal, sisnyal dua dimensi, penilaian kualitas citra, teori sistem pencitraan medis, fisika radiografi, meliputi pembangkitan dan deteksi ionisasi radiasi dan efeknya terhadap tubuh manusia. Sistem radiografi proyeksi, meliputi sinar-x dan sistem fluoroskopi. Matematika pencitraan proyeksi, dasar ide pencitraan medis. *X-ray computed tomography*. Cara CT menghasilkan tomogram, fisika kedokteran nuklir, konsep pencitraan berbasis radioaktif, *emission computed tomography*. Fisika suara, beberapa modalitas pencitraan: *Ultrasonography. Magnetic resonance imaging*, fisika resonansi magnetik nuklir..			
	Introduction. Review of signal processing, emphasis on two-dimensional signals, and a discussion of image quality, theory of medical imaging systems, physics of radiography, including the generation and detection of ionizing radiation and its effect on the human body. Projection radiography systems, including chest x-ray and fluoroscopy systems. The mathematics of projection imaging, a very fundamental idea in medical imaging. X-ray computed tomography. Computed tomography produces true tomograms, physics of nuclear medicine, focusing primarily on the concept of radioactivity. emission computed tomography. physics of sound, various imaging modality. magnetic resonance imaging. physics of nuclear magnetic resonance, and various magnetic resonance imaging techniques.			
Luaran (Outcomes)	5. Memahami ruang lingkup pengolahan citra digital, khususnya di bidang medis dan biologi. 6. Memahami secara teori dan mengimplementasikan aspek dari dasar teknik pengolahan citra digital. 7. Mampu menganalisis masalah pengolahan citra dan merancang solusinya menggunakan teknik pengolahan citra digital. 8. Mampu mengidentifikasi implementasi terkini dari pengolahan citra, terutama di bidang medis dan biologi.			
Matakuliah Terkait	EL5100 Teknik Biomedika	Prasyarat		
Kegiatan Penunjang				
Pustaka	Medical Imaging Signals and Systems, Jerry L. Prince and Jonathan Links, 2005 (*Pustaka utama*)			
	Foundations of Medical Imaging. Z. H. Cho, Joie P. Jones, Manbir Singh. 1993 (*Pustaka alternatif*)			
	Introduction to Biomedical Imaging (IEEE Press Series on Biomedical Engineering). Andrew G. Webb. 2002 (*Pustaka pendukung*)			
Panduan Penilaian	Tugas 20%, Kuis 20 %, UTS 30%, UAS 30 %			
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pendahuluan	Perkenalan: jadwal kuliah, ruang lingkup, skema penilaian Sejarah pencitraan medis	Mahasiswa memahami aturan perkuliahan: jadwal kuliah, ruang lingkup, danskema penilaian Mahasiswa mengetahui sejarah pencitraan medis beserta kekurangan dan kelebihan masing-masing modalitas pencitraan	Bab 1 [1] Bab 1 [2]
2	Pengolahan sinyal, sinyal 2 dimensi	Sinyal dan sistem, transformasi Fourier, dasar-dasar pengolahan citra digital	Mahasiswa memahami dasar-dasar pengolahan sinyal 2 dimensi, tranformasi Fourier, pengolahan citra: enhancement, restorartion, reconstruction	Bab 2 [1] Bab 2 [2]
3	Sistem Pencitraan Medis I	Kualitas citra, meliputi resolusi, derau, kontras, distorsi geometris, dan artifak	Mahasiswa memahami sistem pencitraan medis: resolusi, derau, kontras, distorsi geometris, dan artifak	Bab 3 [1] Bab 3 [2]
4	Sistem Pencitraan Medis II	Signal-to-Noise ratio, efek nonrandom, akurasi: akurasi kuantitatif dan diagnostik	Mehasiswa memahami konsep penilaian kualitas citra (Signal-to-Noise ratio) dan akurasi kuantitatif maupun akurasi diagnostik	Bab 3 [1] Bab 4 [2]
5	Sistem radiografi	Fisika radiografi, instrumentasi, pembentukan citra, derau dan hamburan	Mahasiswa memahami konsep sifat fisis radiografi, mulai dari sistem instrumentasi radiografi, proses pembentukan citra di radiografi, derau yang mungkin akan timbul, dan hamburan sinar yang dihasilkan. Mahasiswa mengerti aspek keamanan (safety) di radiografi	Bab 4 - 5 [1] Bab 5 [2]
6	x-ray computed tomography I	CT instrumentation, Image formation	Mahasiswa memahami dasar-dasar tomografi, instrumentasi CT, dan proses pembentukan citra di CT-Scan	Bab 6 [1] Bab 6 [2]
7	x-ray computed tomography II	Parallel-ray reconstruction, Fan-beam reconstruction, helical CT reconstruction, Cone beam CT	Mahasiswa memahami berbagai teknik lanjutan di CT-Scan, mulai dari teknik awal rekonstruksi (parallel x-ray) sampai dengan teknik paling mutakhir (cone beam).	Bab 6 [1] Bab 6 [2]

8	nuclear medicine,	Physics of nuclear medicine, radioactive decay, planar scintigraphy	Mahasiswa memahami konsep dan aspek keamanan (safety) di kedokteran nuklir. Mahasiswa mengerti keuntungan dan kerugian menggunakan kedokteran nuklir.	Bab 7 [1] Bab 7 [2]
9	Emission computed tomography,	Instrumentation, image formation, SPECT and PET	Mahasiswa memahami beberapa teknik lanjutan dalam pencitraan medis menggunakan kedokteran nuklir, meliputi SPECT dan PET.	Bab 9 [1] Bab 7 - 8 [2]
10	Ultrasound I	Physics of ultrasound	Mahasiswa memahami sifat fisis dari suara dan konsep dasar pengolahan citra menggunakan ultrasonografi	Bab 10 [1] Bab 14 [2]
11	Ultrasound II	Ultrasound imaging systems	Mahasiswa memahami sistem pencitraan medis berbasis ultrasound: A-mode, M-mode, dan B-mode	Bab 11 [1] Bab 15 [2]
12	Magnetic resonance imaging I	Physics of magnetic resonance	Mahasiswa memahami sifat fisis resonansi magnetic yang diaplikasikan dalam pencitraan tomografi	Bab 12 [1] Bab 9 - 10 [2]
13	Magnetic resonance imaging II	Instrumentation, MRI data acquisition, image reconstruction	Mahasiwa memahami sistem instrumentasi, akuisisi data, dan rekonstruksi citra MRI	Bab 13 [1] Bab 11 - 12 [2]
14	Tugas besar	Tbd	Mahasiswa memahami dan mampu menerapkan konsep dan materi pencitraan biomedika yang sudah disampaikan dalam sebuah persoalan medis.	Semua referensi + berbagai sumber yang relevan
15	Tugas besar	Tbd	Mahasiswa memahami kembali materi ajar yang telah disampaikan, menerapkannya dalam sebuah persoalan, memberikan analisis yang sesuai, serta menyampaikannya dalam bentuk laporan/presentasi tugas besar.	Semua referensi + berbagai sumber yang relevan

Silabus dan Satuan Acara Pengajaran (SAP) EL6009

Kode Matakuliah: EL6009	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Biomaterial
	Biomaterials

Silabus Ringkas	Introduction, , Biomaterials Metals, Metallic Biomaterials, Ceramic and Related Materials, Ceramic Biomaterial, Polymers, Polimeric Biomaterials, Composite Materials, Composite Biomaterials, Biodegradable Polymeric , Biomaterials, Biologic Biomaterials, Soft Tissue Replacemnts, Hard Tissue Replacements, Controlling and Assessing Cell-Biomaterial Interaction
	Introduction, , Biomaterials Metals, Metallic Biomaterials, Ceramic and Related Materials, Ceramic Biomaterial, Polymers, Polimeric Biomaterials, Composite Materials, Composite Biomaterials, Biodegradable Polymeric , Biomaterials, Biologic Biomaterials, Soft Tissue Replacemnts, Hard Tissue Replacements, Controlling and Assessing Cell-Biomaterial Interaction

Silabus Lengkap	Pendahuluan . Biomaterial: Definisi, sejarah awal biomaterial. Metals: Stainless steels, Co-Based Alloys, Ti & Ti-Based Alloys. Metallic Biomaterials: Dental metals, corrosion. Ceramic: Structure-Property relationship of ceramics. Ceramic Biomaterial: Kalsium fosfat, Glass-ceramics. Polymers: Polymerization and properties, Effect of structural modification and temperature. Polimeric Biomaterials: implant materials, High-strength thermoplastics, Deterioration of Polymers. Composite Materials: Struktur, Mekanika. Composite Biomaterials: Aplikasi dan biokompatibilitas. Biodegradable Polymeric Biomaterials: Aplikasi dan biokompatibilitas komposit. Biologic Biomaterials: Protein, polisakarida. Soft Tissue Replacements: body response to implants, blood compatibility, karsinogenik. Hard Tissue Replacements: Wires, Pins, Screws, Fracture plates, Intramodullary devices, Joint replacements. Controlling and Assessing Cell-Biomaterial Interaction: Immunological considerations, regeneration.
	Pendahuluan . Biomaterial: Definisi, sejarah awal biomaterial. Metals: Stainless steels, Co-Based Alloys, Ti & Ti-Based Alloys. Metallic Biomaterials: Dental metals, corrosion. Ceramic: Structure-Property relationship of ceramics. Ceramic Biomaterial: Kalsium fosfat, Glass-ceramics. Polymers: Polymerization and properties, Effect of structural modification and temperature. Polimeric Biomaterials: implant materials, High-strength thermoplastics, Deterioration of Polymers. Composite Materials: Struktur, Mekanika. Composite Biomaterials: Aplikasi dan biokompatibilitas. Biodegradable Polymeric Biomaterials: Aplikasi dan biokompatibilitas komposit. Biologic Biomaterials: Protein, polisakarida. Soft Tissue Replacements: body response to implants, blood compatibility, karsinogenik. Hard Tissue Replacements: Wires, Pins, Screws, Fracture plates, Intramodullary devices, Joint replacements. Controlling and Assessing Cell-Biomaterial Interaction: Immunological considerations, regeneration.

Luaran (Outcomes)	1. Memahami ruang lingkup biomaterial (di bidang medis dan biologi). 2. Memahami sifat-sifat dasar biomaterial secara komprehensif dan terintegrasi. 3. Mampu mengaplikasikan dan merancang solusi dari masalah-masalah di bidang biomaterial. 4. Mampu mengidentifikasi implementasi terkini dari biomaterial (di bidang medis dan biologi).

Matakuliah Terkait	Teknik Biomedika dan Praktikum	Prasyarat

Kegiatan Penunjang	Tugas besar

Pustaka	Sudaryatno Sudirham. Catatan Kuliah Material Biomedika. 2012 (Pustaka utama)
	Zbigniew D Jastrzebski. The Nature And Properties of Engineering Materials. John Wiley & Sons, 1987 (Pustaka alternatif)
	Joon Park R.S. Lakes. Biomaterials: An Introduction, Third Edition. Springer. 2007. ([Pustaka pendukung])

Panduan Penilaian	Tugas besar: 20 %, Kuis: 20%, UTS: 30 %, UAS: 30 %

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pendahuluan	Perkenalan: jadwal kuliah, ruang lingkup, skema penilaian	Mahasiswa memahami aturan perkuliahan: jadwal kuliah, ruang lingkup, dan skema penilaian.	Bab 1 - 17 [1]
2	Biomaterial	Definisi, kinerja biomaterial, sejarah awal biomaterial	Mahasiswa mengetahui definisi, sejarah biomaterial.	Bab 18 [1] Bab 1 [3]
3	Metals	Stainless steels, Co-Based Alloys, Ti & Ti-Based Alloys	Mahasiswa memahami sifat-sifat dan jenis metal	Bab 19 [1] Bab 8 [2]
4	Metallic Biomaterials	Dental metals, other metals, corrosion of metallic implants	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat dari metallic biomaterials	Bab 20 [1] Bab 9 [2]
5	Ceramic and Related Materials	Structure-Property relationship of ceramics, Alumina, Zirconia	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat keramik	Bab 21 [1] Bab 10 [2]
6	Ceramic Biomaterial	Kalsium fosfat, Glass-ceramics, other ceramics	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat biokeramik: keuntungan dan kerugian	Bab 22 [1] Bab 11 [2]
7	Polymers	Polymerization and properties, Effect of structural modification and temperature on properties	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat polimer	Bab 23 [1] Bab 12 [2]
8	Polimeric Biomaterials	Polymeric implant materials, High-strength thermoplastics, Deterioration of Polymers	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat biomaterial polimer	Bab 24 [1] Bab 13 [2]
9	Composite Materials	Struktur, Mekanika komposit	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat material komposit	Bab 25 [1] Bab 14 [2]
10	Composite Biomaterials	Aplikasi dan biokompatibilitas komposit	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat biomaterial komposit	Bab 26 [1] Bab 15 [2]
11	Biodegradable Polymeric Biomaterials	Aplikasi dan biokompatibilitas komposit	Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat biodegradable	Bab 27 [1] Bab 16 [2]

12	*Biologic Biomaterials*	*Protein, polisakarida*	*Mahasiswa memahami dan mengetahui aplikasi dan sifat-sifat biomaterial di bidang biologi*	*Bab 28 [1]* *Bab 17 [2]*
13	*Soft Tissue Replacements*	*Normal wound-healing process, body response to implants, blood compatibility, karsinogenik*	*Mahasiswa memahami penggantian jaringan lunak tubuh*	*Bab 29 [1]* *Bab 18 [2]*
14	*Hard Tissue Replacements*	*Wires, Pins, Screws, Fracture plates, Intramodullary devices, Joint replacements*	*Mahasiswa memahami penggantian jaringan keras tubuh*	*Bab 30 [1]*
15	*Controlling and Assessing Cell-Biomaterial Interaction*	*Immunological considerations, regeneration*	*Mahasiswa memahami pengontrolan dan penilaian interaksi biomaterial di level sel*	*Bab 31 [1]*

Silabus dan Satuan Acara Pengajaran (SAP) EL6010

Kode Matakuliah: EL6010	Bobot sks: 2	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Instrumentasi Biomedika			
	Biomedical Instrumentation			
Silabus Ringkas	Pendahuluan. Dasar-dasar Instrumentasi Biomedika. Dasar-dasar alat biomedika, Potensial bio-listrik. transduser dan sensor, penguat biomedika. Alat bantu diagnosa & terapi: peralatan laboratorium klinik. Instrumentasi Pencitraan Biomedika. Perkembangan baru dalam Instrumentasi Biomedika.			
Silabus Lengkap	Pendahuluan: penjelasan umum matakuliah. Dasar-dasar Instrumentasi Biomedika, informasi kedokteran, prosedur kedokteran. Dasar-dasar alat/sistem biomedika, diagram blok, bagian, fungsi dan cara kerjanya; contoh, Potensial bio-listrik: dasar-dasar, karakteristik dan cara pengukurannya; transduser dan sensor, penguat biomedika. Alat bantu diagnosa & terapi: mengulang alat2 bantu diagnosa & terapi sederhana, alat ukur tekanan darah, alat ukur sistem pernafasan, peralatan laboratorium klinik. Lithotripter, Peralatan X-ray dan ultrasonic, MRI. Perkembangan baru dalam Instrumentasi Biomedika.			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	Introduction to Biomedical Equipment Technology. Carr & Brown. Prentice-Hall, 2001 (*Pustaka utama*)			
	Biomedical Instruments: Application & Design. John G.Webster. John Wiley, 1998 (*Pustaka alternatif*)			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Pendahuluan	penjelasan umum matakuliah.		
2	Data medis	informasi kedokteran, prosedur kedokteran.		
3	Potensial bio-listrik	dasar-dasar, karakteristik dan cara pengukurannya;		
4	Dasar-dasar alat/sistem biomedika	diagram blok, bagian, fungsi dan cara kerjanya; contoh		
5	Dasar-dasar Instrumentasi Biomedika	transduser dan sensor, penguat biomedika.		
6	Alat bantu diagnosa I			
7	Alat bantu diagnosa II			
8	Alat bantu terapi I			
9	Alat bantu terapi II			
10	alat ukur tekanan darah,			
11	alat ukur sistem pernafasan,			
12	peralatan laboratorium klinik.			
13	Lithotripter,			
14	Peralatan X-ray dan ultrasonic, MRI.			
15	Perkembangan baru dalam Instrumentasi Biomedika.			

Silabus dan Satuan Acara Pengajaran (SAP) EL5099

Kode Matakuliah: EL5099	Bobot sks: 3	Semester: Ganjil / Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Prodi

Nama Matakuliah	Pra Tesis
	Pra Theses
Silabus Ringkas	A final, individual project intended to integrate material already covered in previous courses, as well as to provide an in-depth exploration of a topic of special interest or career relevance to the participant. Students work closely with an academic advisor and are required to submit a comprehensive written report as well as make an oral presentation of the research results in front of a professional academic panel.
Silabus Lengkap	1. Explain and apply relevant theories, methods, practical techniques, and facts in a choosen area 2. Interpret data, draw logical conslusions from them, and give recommendations were appropriate. 3. Apply knowledge, experience and skills learned to a choosen situation in a multi-disciplinary way 4. Demonstrate the ability to tackle problematic issues and look at a problem from various perspectives 5. Show the ability to analyse various aspects of a topic 6. Review and synthesise knowledge, make judgements and reasoned arguments 7. Apply various research techniques, find suitable sources of information and acknowledge them in the theses
Luaran (Outcomes)	To introduce students to the research prospectus and thesis writing process
Matakuliah Terkait	EL5090 Metoda Penelitian — Prasyarat
Kegiatan Penunjang	
Pustaka	
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
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Silabus dan Satuan Acara Pengajaran (SAP) EL6101

Kode Matakuliah: EL6101	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Komputer Terdistribusi
	Distributed Computing

Silabus Ringkas	

Silabus Lengkap	This course focuses on concepts in the design and implementation of distributed computing systems. Models for distributed application development will be discussed. Practical work involves technologies such as TCP/UDP sockets, RPC, multicasting and multi-threaded server design. Topics include introduction to distributed computing, design issues, communication protocols, synchronization in distributed systems, management of time, causality, logical clocks, consistent global states, distributed mutual exclusion, distributed deadlock detection, election algorithms, agreement protocols, consensus, multicast communication, distributed transactions, replication, distributed file systems, fault tolerance, security.

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	Andrew S. Tanenbaum, Maarten van Steen, "Distributed Systems: Principles and Paradigms", 1/e, Prentice Hall, 2002.
	George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems: Concepts and Design", Edition 4, Addison-Wesley, 2005.
	Kenneth P. Birman, "Reliable Distributed Systems: Technologies, Web Services, and Applications", Springer Verlag, 2005.
	Sape Mullender, "Distributed Systems", 3rd Edition, Addison Wesley, 1998.

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction	• Definition Of A Distributed System • Goals 3 • Types Of Distributed Systems		1
2	Architectures	• Architectural Styles • System Architectures • Architectures Versus Middleware • Self-Management In Distributed Systems		1
3	Processes	• Threads • Virtualization • Clients • Servers • Code Migration		1
4	Communication	• Fundamentals • Remote Procedure Call • Message-Oriented Communication • Stream-Oriented Communication • Multicast Communication		1
5	Naming	• Names, Identifiers, And Addresses • Flat Naming • Structured Naming • Attribute-Based Naming		1
6	Synchronization	• Clock Synchronization • Logical Clocks • Mutual Exclusion		1

		• Global Positioning Of Nodes • Election Algorithms		
7	Consistency And Replication	• Introduction • Data-Centric Consistency Models • Client-Centric Consistency Models • Replica Management • Consistency Protocols		1
8	Fault Tolerance	• Introduction To Fault Tolerance • Process Resilience • Reliable Client-Server Communication • Reliable Group Communication • Distributed Commit • Recovery		1
9	Security	• Introduction To Security • Secure Channels • Access Control • Security Management		1
10	Distributed Object-Based Systems	• Architecture • Processes • Communication • Naming • Synchronization • Fault Tolerance • Security • Summary		1
11	Distributed File Systems	• Architecture • Processes • Communication • Naming • Synchronization • Consistency And Replication • Fault Tolerance • Security		1
12	Distributed Web-Based Systems	• Architecture • Processes • Communication • Naming • Synchronization • Consistency And Replication • Fault Tolerance • Security		1
13	Distributed Coordination-Based Systems (I)	• Introduction To Coordination Models • Architectures • Processes • Communication		1
14	Distributed Coordination-Based Systems (II)	• Naming • Synchronization • Consistency And Replication • Fault Tolerance • Security		1

Silabus dan Satuan Acara Pengajaran (SAP) EL6102

Kode Matakuliah: EL6102	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Pemrograman Jaringan Lanjut			
Silabus Ringkas				
Silabus Lengkap	This course will give a more in-depth treatment of unix network programming. This course will cover using standard UNIX system call API's, network programming, including the client-server paradigm, writing portable application programs, interprocess communications, thread programming, OpenMP, and MP			
Luaran (Outcomes)				
Matakuliah Terkait	Network Programming		Prasyarat	
Kegiatan Penunjang				
Pustaka	W. Richard Stevens, "UNIX Network Programming, Volume 1: Networking APIs - Sockets and XTI", 2nd edition Englewood Cliffs, NJ: Prentice Hall. 1997.			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Preliminaries	Introduction to networking The Java security model An overview of exceptions An overview of multithreading An overview of JDBC		
2	Streams	An introduction to streams File streams Filter streams Memory I/O streams Character streams Object streams		
3	Networking	Client-side networking Server-side networking HTTP networking Datagram networking Multicast networking		
4	Alternative Technologies	RMI RMI activation CORBA Servlets		
5	Message Streams	Message streams Queuing message streams Multiplexing message streams Routing message streams		
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Silabus dan Satuan Acara Pengajaran (SAP) EL6103

Kode Matakuliah: EL6103	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Sistem Operasi Lanjut			
	Advanced Operating System			
Silabus Ringkas				
Silabus Lengkap				
	This course is intended to give you a broad exposure to advanced operating systems topics. We will be reading about and discussing such topics as protection, security, memory management, operating system kernels, file systems, synchronization, naming, and distributed systems.			
Luaran (Outcomes)				
Matakuliah Terkait	Operating System	Prasyarat		
Kegiatan Penunjang				
Pustaka	Title: Distributed Operating Systems Author: Andrew S. Tanenbaum Publisher: Prentice Hall; 1995			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	*Hardware concepts of distributed systems*			
2	*• Software concepts and design issues*			
3	*• Communication in distributed systems*			
4	*• Threads and thread usage*			
5	*• Multithreading operating system*			
6	*• Client – server model* *• Implementation of Client-server model*			
7	*• Remote procedure call* *• Implementation of remote procedure call*			
8	*• Synchronization in distributed systems* *• Clock synchronization*			
9	*• Mutual exclusion Page 2 of 5* *• Election algorithms* *• Transaction and concurrent control*			
10	*• Deadlock in distributed systems* *• Processor Allocation*			
11	*• Real – time distributed systems* *• Distributed file systems*			
12				

Silabus dan Satuan Acara Pengajaran (SAP) EL6104

Kode Matakuliah: EL6104	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Analisis Kinerja Jaringan
	Network Performance Analysis
Silabus Ringkas	
Silabus Lengkap	Internet network layer protocols. User services and source traffic models. Traffic measurement, estimation and forecasting. Performance analysis and simulation tools. Traffic control and resource management. Including: schedulling and buffer management, flow/congestion control, QoS mechanism, routing, applications and middlewares. • Probability revision: Probability basics, random variables. Markov chains. Exponential distribution, Poisson process, Markov process. • Shared access networks: (Aloha, ethernet, Wifi.) Throughput. Markov and fluid models for retransmission. Signalling, token ring. • Allocated bandwidth schemes: (PSTN, Intserv.) Erlang link. Erlang fixed point. Alternative routing. Effective bandwidth. • TCP: Windowed flow control, TCP mechanism. Throughput models-naive, Markov, fluid. Fixed point. • Optimality and design: Teleology of TCP.
Luaran (Outcomes)	
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Van Jacobson, "Congestion Avoidance and Control", 1988.
	Gibbens et al., "Fixed-Point Models for The End-to-End Performance Analysis of IP Networks", 2000.
	T.Bu and D.Towsley, "Fixed Point Approximation for TCP behavior in an AQM Network", 2001.
	F.Kelly, "Models for a self-managed Internet", 1999.
	Gerald Ash, "Traffic Engineering and QoS Optimization of Integrated Voice & Data Networks", Elsevier, 2007.
	W. Stallings, "High-Speed Networks and Internets: Performance and Quality of Service", Prentice Hall, 2nd Ed., 2002.
	E. Osborne, "Traffic Engineering with MPLS", Cisco Press, 2002.
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Discrete and continuous random variables			
2	Stochastic processes			
3	Markov/Poisson/Renewal random processes			
4	Basic queuing theory			
5	Statistical inference			
6	Performance analysis tools			
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Silabus dan Satuan Acara Pengajaran (SAP) EL6105

Kode Matakuliah: EL6105	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Sistem Embedded & Waktu-Nyata
	Embedded System & Real Time
Silabus Ringkas	In this course, students design and build a microprocessor-based embedded system application requiring integration of sensor/actuator devices, a real-time operating system and application firmware and software. The course includes a theory module covering real-time rate monotonic theory, system resource sizing and management, and implementation process and testing specific to real-time systems.
Silabus Lengkap	Topics: • Rate Monotonic Theory, specifically the RM least upper bound, necessary and sufficient feasibility tests, and application of rate monotonic theory • Real-time Operating Systems, scheduling, synchronization mechanisms, and resource management • Embedded system architectures: System-on-chip, scalable bus architectures, memory subsystems • Sensor and Actuator IO: ADC, DAC, servos, relays, stepper motors, H-bridge, and CODECs • Real-time embedded test equipment, software debug tools, and methods of performance profiling and tracing • Real-time applications including voice/packet-switched links and networks, streaming video media, computer vision, digital control, and robotic system command and control
Luaran (Outcomes)	
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Sam Siewert, "Real-Time Embedded Components and Systems", ISBN 1584504684, publisher link, Amazon link, Softpro Books, Barnes&Noble, also available in CU bookstore. Tom Shanley and Don Anderson, PCI System Architecture, 4th Edition, 1999, (ISBN 0-201-30974-2) MindShare, Inc., and several on-line texts.
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction	a. Definition of embedded system b. Constraints on embedded systems vs. standalone systems c. Concept of real-time design d. Time scales for real-time system e. Applications		
2	Hardware/software functional partitioning	a. Relevant hardware technologies: Discrete logic, CPLDs, FPGAs, ASICs b. Software environments: HLL vs. assembly coding, DSP vs. general purpose computer vs. RISC		
3	Development environments; course project definition			
4	System architectures			
5	Pipelining, interrupt service routines			
6	Software structures	a. ISRs b. Polling c. semaphores		
7	Evaluating system performance – correctness, speed			
8	Continuation of system			

	performance evaluation			
9	*Profiling system performance*			
10	*Continuation of performance profiling*			
11	*Performance optimization*	*a. Optimizing compilers* *b. Pareto Principle*		
12	*Future directions*			
13				
14				

Silabus dan Satuan Acara Pengajaran (SAP) EL6106

Kode Matakuliah: EL6106	Bobot sks: 4	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	Metode Perancangan Sistem Embeded
	Embedded System Design Methodology
Silabus Ringkas	Mata kuliah ini membahas issue-issue dan perancangan embedded system terutama dengan tema hardware/software co-design
	This course discusses issues and methods of designing an embedded system. Main attention is given to hardware/software codesign
Silabus Lengkap	- istilah, isue dan tantangan dalam pengembangan embedded system - pemilihan dan pengenalan perangkat keras - scheduler - macam-macam system operasi - tool untuk codesign dan pengembangan software development - pemanfaatan berbagai platform pengembangan - co-design - engineering design cycle - prototyping - term, issues and challenge in embedded system - hardware - scheduler - operating system - various tools for codesign and software development - platform - co-design - engineering design cycle - prototyping
Luaran (Outcomes)	1. Understand the characteristics, types, and constraints of various embedded systems 2. Understand the hardware/software trade-offs inherent in embedded systems 3. Understand various elements of complex embedded systems such as operating system, networking stack, and transducers 4. Be able to apply this understanding to carry out the design process 5. Become familiar with a range of design methodologies through their application to a design problem
Matakuliah Terkait	Arsitektur Sistem Komputer / Sistem Mikroprosessor — Prasyarat Instrumentasi — Prasyarat / Bersamaan Pemrograman — Prasyarat
Kegiatan Penunjang	Simulasi, praktikum, project
Pustaka	"Embedded System Design: A Unified Hardware/Software Introduction", Frank Vahid/Tony Givardis "Design for Electrical and Computer Engineers: Theory, Concepts, and Practice", Ralph M. Ford, Mc Graw Hill International "Embedded System: Architecture, Programming and Design", Raj Kamal, Chapter 12 [2] "Practical UML Statecharts in C/C++, event-Driven prohramming for Embedded System Second Edition", Miro Samek, Newnes
Panduan Penilaian	Presentation & Discussion, Writing Paper, Project, Examination
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introductory	• Constraints, types and characteristics of embedded systems • Basics Knowledge and Terms in Embedded System Design	• Know basic term in embedded system • Understand on issues in embedded system • Understand of challenge and current/advances issues in the embedded system design in various type of embedded system	
2	Hardware in embedded system	Processor, interfacing, computing node, peripherals, transducers, bus	• Understand interfacing of Hardware • Design and implement various interfacing in hardware	
3	Software aspect in embedded system	Operating System, Programming Language, Software model	• Understand interfacing of hardware and software • Designing and implementing interfacing in software • Understand effect of scheduler	

Bidang Akademik dan Kemahasiswaan ITB	**Kur2013-S2-EL**	**Halaman 100 dari 159**

Template Dokumen ini adalah milik Direktorat Pendidikan - ITB
Dokumen ini adalah milik Program Studi Magister Teknik Elektro ITB.
Dilarang untuk me-reproduksi dokumen ini tanpa diketahui oleh Dirdik-ITB dan EL-ITB.

			• Know various OS • Able to use an operating system	
4	Software development tools	GNU tool, software project management tools	• Able to explain various tools and use a specific tools	
5	Various platform In Embedded System Prototyping	Prototyping board, FPGA dev board	• Able to chose a platform to develop particular project	
6	System Design	Live Cycles in System Engineering	• Create various documents in system design according to the development stages	
7	Tools and Methods	• Co-design • Tool • Simulation	• Understand of HW/SW codesign • Understand challange of Codesign	
8	System on Chip	• SoC • Implement SoC on FPGA		
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Silabus dan Satuan Acara Pengajaran (SAP) EL6107

Kode Matakuliah: EL6107	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Implementasi Kriptografi
	Cryptography Implementation
Silabus Ringkas	Mata kuliah ini membahas perancangan *transceiver* radio. Bahasan meliputi arsitektur tranceiver dan rangkaian pembentuk-nya. Rangkaian-rangkaian ini meliputi *mixer*, penguat *low noise*, penguat daya frekuensi radio, dan bagian front end lainnya
	This course discusses the design of radio tranceiver. The topics include transceiver architecture and its building circuits. These circuits are mixer, low noise amplifier (LNA), and other part of the analog front end transceiver
Silabus Lengkap	• Dasar-dasar perancangan *transceiver* radio • arsitektur transmitter • arsitektur receiver • *mixer* • penguat *low noise* • penguat daya frekuensi radio • distorsi dan noise • modulasi analog dan digital • studi kasus perancangan transceiver radio
	• Basics of radio transceiver design • Transmitter architecture • Receiver architecture • mixer • low noise amplifier • RF power amplifer • distortion and noise • modulation (analog and digital) • RF Transceivers Case Studies
Luaran (Outcomes)	6. Peserta mengerti dan dapat melakukan *perancangan IC analog* dan *mixed signal* 7. Peserta mengetahu topik-topik lanjut dalam perancangan IC analog dan mixed signal
Matakuliah Terkait	Elektronika 2 | Prasyarat
Kegiatan Penunjang	Simulasi, praktikum, project
Pustaka	
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	PengantarKriptografi	Overview Kriptografi, Overview Cryptology, Jenis – jenis kriptografi, Simmetric Cryptography, Asymmetric Cryptography, Hash Function, Overview Analisis sandi, Jenis-jenis attack	1. Menjelaskan manfaat kriptografi dan peranannya dalam keamanan sistem informasi 2. Menjelaskan macam-macam attack dan analisis sandi	
2	Kriptografi klasik dan analisis sandi	Macam Cipher subtitusi dan transposisi, kombinasi, Analisis sandi cipher klasik	1. Memahami macam-macam cipher klasik 2. Memahami dasar analisis sandi	
3	Matematika kriptografi	Teori bilangan, Dasar aljabar abstrak	1. Memahami teori bilangan dan aljabar abstrak 2. Menggunakan matematika dalam kriptografi	
4	Block cipher DES dan AES	Mempelajari DES, 3DES, AES, Blowfish, Twofish, danlainnya	3. Memahami cara kerja berbagai algoritma block cipher. 4. Memahami kelebihan dan kekurangan algoritma 5. Analisis keamanan dasar block cipher dasar	
5	Stream cipher	One Time Pad, OTP Tiruan, Mode CFB, OFB, CTR	1. Memahami cara kerja berbagai stream cipher 2. Analisis keamanan dasar stream cipher	
6	Fungsi hash	MD5, SHA-1, SHA-2, SHA-3	1. Memahami Fungsi hash d102anisi algoritmanya	

			2. Analisis keamanan dasar Fungsi hash	
7	Algoritma asimetri	RSA, ECC, DH, algoritmaasimetrik yang lain	1. Memahami cara kerja berbagai algoritmaasimetrik 2. Memahamidasarkeamananalgoritmaasimetrik	
8	Aplikasi Kriptografi	SSL, Keamanan GSM dan LTE, keamananWiFi	1. Memahami posisi kriptografi dalam aplikasi dan cara kerjanya 2. Analisis keamanan sistem terkait dengan kriptografi	
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Silabus dan Satuan Acara Pengajaran (SAP) EL6108

Kode Matakuliah: EL6108	Bobot sks: 2	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Proyek Perancangan System Embeded			
Silabus Ringkas				
Silabus Lengkap	The Embedded Systems Design Project aims to provide students with the professional skills needed to create innovative embedded systems. This multidisciplinary product development is realized by combining design with electronics- and software engineering, and other required disciplinary skills. In this course, students will be exposed to real-life industrial needs and situations through close cooperation with industrial partners.			
Luaran (Outcomes)	After the course, each student should be able to: • apply knowledge and skills from earlier courses, as well as learn to acquire new ones on demand; • identify, compare and critically assess aspects of an engineering problem, towards making design decisions; • use professional tools and processes necessary for the development of embedded systems; • learn to get organised, manage, lead and become part of a cross technical and complex development project. The student should after the course have good technical understanding, knowledge and skill in • methods and tools for co-design and optimization of embedded systems; • working through all aspects of an engineering development process; • designing and implementing prototypes. Being part of a larger engineering project, the student will learn how to • apply a model-based development approach to embedded systems development; • apply a fundamental test process; • apply a requirements management method with considerations taken to the life-cycle concerns of embedded systems based products.			
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	INTRODUCTION	Overview of embedded systems, embedded system design challenges, common design metrics and optimizing them		
2	SINGLE-PURPOSE PROCESSORS	Hardware, Combinational Logic, Sequential Logic, RT level Combinational and Sequential Components, Optimizing single-purpose processors. Single-Purpose Processors: Software, Basic Architecture, Operation, Programmer's View, Development Environment, ASIPS.		
3	PERIPHERALS	Standard Single-Purpose Peripherals, Timers, Counters, UART, PWM, LCD Controllers, Keypad controllers, Stepper Motor Controller, A to D Converters, Examples.		
4	MEMORY	Introduction, Common memory Types, Compulsory		

		memory, Memory Hierarchy and Cache, Advanced RAM. Interfacing, Communication Basics, Microprocessor Interfacing, Arbitration, Advanced Communication Principles, Protocolos - Serial, Parallel and Wireless.		
5	*INTERRUPTS*	*Basics - Shared Data Problem - Interrupt latency. Survey of Software Architecture, Round Robin, Round Robin with Interrupts - Function Queues - scheduling - RTOS architecture.*		
6	*INTRODUCTION TO RTOS*	*Tasks - states - Data - Semaphores and shared data. More operating systems services - Massage Queues - Mail Boxes -Timers – Events - Memory Management.*		
7	*RTOS: Part 1*	*Basic Design Using RTOS, Principles- An example, Encapsulating semaphores and Queues*		
8	*RTOS: Part 2*	*Hard real-time scheduling considerations – Saving Memory space and power.*		
9	*RTOS: Part 3*	*Hardware software co-design aspects in embedded systems.*		

Silabus dan Satuan Acara Pengajaran (SAP) EL6109

Kode Matakuliah: EL6109	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	System on Chip (SoC)
	System on Chip
Silabus Ringkas	This course has an objective to provide student with the understanding and capability in designing System on Chip. In this course, learn how to configure an Embedded Processor for different application. Student also learn on how to partition a system into Hardware and software, designing an IP to be attached to SoC. The course covers the SoC design constraing, design flow and design guideline for IP design. The student will design a medium size project to understand and experience the whole design process
Silabus Lengkap	4. Introduction to SoC 5. SoC Design Methodology 6. System Design Issue 7. SoC Cores Design 8. Low Power Design 9. Embedded Processor Technology 10. SoC Testing 11. Macro Design 12. RTL Coding Guide 13. Processor Configuration and Implementation for SoC 14. AMBA Bus Design 15. Peripheral Design
Luaran (Outcomes)	Students completing the course should be able to: 4. Having capability of configuring processor for SoC 5. Having capability to design and IP/Macro for SoC 6. Able to apply Design Reuse methodology in IP/Macro design 7. Able to design, simulate and implment in FPGA
Matakuliah Terkait	EL2095 - Sistem Digital — Prasyarat EL4045 - Analisis dan Perancangan IC Digital
Kegiatan Penunjang	
Pustaka	Reuse Methodology Manual For System on Chip Designs 2nd Edition By Micheael Keating Pierre Bricaud
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to SoC		What and why Systems-on-a-Chip (SoC), Definition, Challenge and Constrain, Long-Term Trends, Business Issue	
2	SoC Design Methodology		The detail Design Flow and its development model	
3	System Design Issue		Explains about tools and rules in SoC design	
4	SoC Cores Design		SoC IP/Core design flow and rules. Including IP interconnection and verification	
5	Low Power Design		Introduce design methodology to lower power consumption SoC	
6	Embedded Processor Technology		Explain about various embedded processor type that typically used in SoC	
7	SoC Testing		Design the SoC to increase observability and controllability for testing	
8	Macro Design		A guideline to design a good Macro	
9	RTL Coding Guide		A guideline to design a good RTL for SoC	
10	Processor Configuration and Implementation for SoC		Lear to configure and implement a processor for SoC	
11	AMBA Bus Design		Detail explanation about AMBA bus configuration and how to use	

			it	
12	Peripheral Design		Design example of peripheral design that is ready for SoC integration	
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Silabus dan Satuan Acara Pengajaran (SAP) EL6110

Kode Matakuliah: EL6110	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Manufaktur dan Industri Elektronika
	Electronics Manufacture and Industry
Silabus Ringkas	Mata kuliah ini membahas issue-issue dalam industry dan proses manufaktur elektronika. Khususnya teknologi PCB dan SMT.
	This course discusses issues on electronics industry and electronics manufacture. The focus will be on the PCB and SMT technology
Silabus Lengkap	- Komponen elektronika - Material PCB - Perancangan dan assembly - Proses soldering - Packaging - Aspek ekonomi
	- Electronics components - Substrates of PCB - Design and Assembly - Wave and Reflow Soldering process - Packaging - Economics Consideration
Luaran (Outcomes)	1. Mengetahui proses pada manufaktur elektronika secara umum 2. Mengerti proses pada manufaktur PCB dan SMT 3. Mengerti aspek ekosistem dan ekonomi pada industry elektronika
Matakuliah Terkait		
Kegiatan Penunjang	Simulasi, praktikum, project
Pustaka	
Panduan Penilaian	Presentation & Discussion, Writing Paper, Examination
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction	Covering the features of the course, the design structure, and methodologies, Critical issues on Surfacce Mount Technology, SMT.		
2	Components	Overview of package technology, Wire/Tape Automated Bonding, IC Packages, Passive Components, Thermal Characteristics of SMC's.		
3	Subtrates	Types of Subtrates and interconnections, PCB Fabrications.		
4	Design and Assembly	SMC's Single-sided and Double-Sided, PCB Layout and Design Constrains, Conductor Routing, Computer Aided Design, Component Placement		
5	Wave and Reflow Soldering	Temperature Adhesive Bonding, Fluxing the Board, The Solder Wave, The Solder Alloy, Application of the Paste, Radiation Heat Transfer, and Infra-Red Processing		
6	High Power Packaging	Calculatios of the actual		

	for Sufrace Mount Devices (SMD's) :	power dissipation with low- and high- frequency operation. Calculation of thermal resistances and responses using CAD tools		
7	Quality and realibility :	Reliability behavior and functions, Temperature sensitive parameters, Practical reliability		
8	Economics :	Manufacturing costs, Assembled system cost, Yield calculations		
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Silabus dan Satuan Acara Pengajaran (SAP) EL5228

Kode Matakuliah: EL5228	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Keamanan Sistem Operasi			
	OS Security			
Silabus Ringkas	This course covers both fundamentals topics in operating system (OS) security. It will study OS level mechanisms and policies in investigating and defending against real-world attacks on computer systems, such as self-propagating worms and large-scale botnets. Basic OS security techniques such as logging, system call auditing, and memory protection will be discussed. Recent advanced techniques such as honeypots and honeyfarms, system randomization, vulnerability fingerprinting, and virtualization will also be introduced.			
Silabus Lengkap	The course focuses on the study of fundamentals in operating system (OS) security. Topics covered: Introduction to OS,Types of Threats, and Basic OS Security Mechanisms; Understanding the Threats; Logging, Auditing, and Recovery; OS-level Memory Protection; Honeypot and Honeyfarm; Virtualization Technology and Applications; Vulnerability Analysis; and Advanced Topics.			
Luaran (Outcomes)	1. Understand design issues in operating systems. 2. Identify role of OS in computer systems and networks. 3. Analyze and assess solutions to various OS problems. 4. Assess popular operating systems. 5. Discuss security issues in OS. 6. Identify key security best practices.			
Matakuliah Terkait	Computer and Network Security	Prasyarat		
Kegiatan Penunjang				
Pustaka	Andrew S. Tanenbaum Modern Operating Systems, 2nd Edition, Prentice Hall PTR, 2001.			
	Michael Palmer Guide to Operating Systems Security, Course Technology, 2004.			
	Matt Bishop Computer Security: Art and Science, Addison Wesley, 2003			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction Operating Systems (OS)**			
2	**Introduction Operating Systems (OS)**			
3	**Types of Threats and Basic OS Security Mechanisms**			
4	**Understanding the Threats**	**Malware Taxonomy, Viruses, Worms, Rootkits, Defense -- An Overview**		
5	**Logging, Auditing, and Recovery**	*Log Generation* *Log Auditing* *Log-based Recovery*		
6	**OS-level Memory Protection**	*Review of OS Memory Management* *NX Bit* *Randomization*		
7	**Honeypot and Honeyfarm**	*Honeypot Taxonomy* *Recent Honeypot Advances*		
8	**Honeypot and Honeyfarm**	*Deployment and Liability*		
9	**Virtualization Technology and Applications**	*Virtualization Taxonomy Security Applications*		
10	**Vulnerability Analysis**	*Vulnerability Classification* *Defense against Known Vulnerabilities*		
11	**Vulnerability Analysis**	*Defense against Unknown (0-day) Vulnerabilities*		
12	**Advanced Topic -- Worms**			
13	**Advanced Topic -- Rootkits**			
14	Advanced Topic -- Botnets			

Silabus dan Satuan Acara Pengajaran (SAP) EL6112

Kode Matakuliah: EL6112	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur

Nama Matakuliah	
	Digital Forensic & Computer Crime
Silabus Ringkas	The objective of this course is to provide the foundations and theoretical underpinnings for an understanding of the way in which data that can subsequently be used as evidence is generated, stored, and transmitted. Based on this, methods for the collection and analysis of digital evidence are covered which will not alter the underlying data or potentially trigger destructive mechanisms and which can be reproduced reliably. This course will also complement other information security courses by examining the subject from the criminal angle; investigate the history and causes of computer crime; examine the effects of computer crime through the experiences of victims and law enforcement
Silabus Lengkap	Introduction: Computer crimes, Viruses, Hacking, Denial of services, Software piracy, Security awareness, The need for computer forensics and examiners activities. Physical Hardware: Types of PC and peripherals, Storage devices, modems, servers, key loggers Computer Evidence and Media forensics: The types of evidence that is presented in court and media forgery detection and source identification. E-Forensic Tasks: Stages of actions and functional steps including tools. Data Analysis: Exact media images, Password issues. Mobile Forensics. Operating systems, specific problems and tools used. Real-Time/Live Forensics: Benefits and disadvantages. Countermeasures: Data protection, Hiding data, Encryption, Security in distribution. Evidence in Court: Legal issues, Investigation report, Transporting, Expert witness, Testifying. Case studies and Tool Boxes: Examples of hardware and software used in computer crime investigation.
Luaran (Outcomes)	1. Understand fundamentals of e-forensics and computer crimes. 2. Familiarize with computer crimes 3. Perform e-forensic investigations 4. Analyze data collected in computer crimes. 5. Use e-forensics tool boxes. 6. Write and present e-forensics reports.
Matakuliah Terkait	Introduction to Cryptography — Prasyarat Computer and Network Security — Prasyarat Advanced Operating Systems — Bersamaan
Kegiatan Penunjang	
Pustaka	Computer Forensics: Computer Crime Scene Investigation, John R. Vacca, Charles River Media, 2002. Digital Evidence and Computer Crime, Forensic Science Computes and the Internet, Eoghan Casey, Elesvier AP 2004. Multimedia Security Technologies for Digital Rights Management, Wenjun Zeng, Heather YU, Ching-Yung Lin, ElesvierAP 2006.
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction: Computer crimes, Viruses, Hacking, Denial of services, Software piracy.			
2	Introduction: Security awareness, The need for computer forensics and examiners activities, Terminology.			
3	Physical Hardware: PC and peripherals, Storage devices, modems, servers, key loggers			
4	Computer Evidence and Media Forensics: Real, documentary, Testimonial, Demonstrative evidence and media forgery, detection and source identification techniques			
5	E-Forensic Tasks: Capturing the data, Volatile data, Duplicating, Extracting			

6	E-Forensic Tasks: Imaging Tools, Verification and authentication, Media conversion			
7	Data Analysis: Extracting information from data, Deleted files, Hidden evidence			
8	Data Analysis: Locations for evidence, data reconstruction, log files and metadata			
9	Mobile Forensics: Range of devices, operating systems and mobile specific problems			
10	Mobile Forensics: Tools techniques and issues			
11	Real-Time/Live Forensics: Trade-off between static and dynamic forensics			
12	Countermeasures: Data protection, Hiding data, Encryption, Security in distribution			
13	Evidence in Court: Legal issues, Formulating reports, Transporting, Expert Witness, Testifying in court			
14	Examples of case studies			

Silabus dan Satuan Acara Pengajaran (SAP) EL6113

Kode Matakuliah: EL6113	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Perancangan Kelanjutan Bisnis
	Business Continuity Plan
Silabus Ringkas	
Silabus Lengkap	
	Addresses the preservation of the business in the face of major disruptions to normal business operations. • Business impact analysis • Recovery strategy • Disaster recovery process • Provide training
Luaran (Outcomes)	Evaluate the organization's business continuity plan to determine the organization's ability to continue essential business operations during the period of an IT disruption
Matakuliah Terkait		
Kegiatan Penunjang	
Pustaka	*Business Continuity and Disaster Recovery for InfoSec Managers*, John Rittinghouse, James Ransome, Digital Press, 2005, ISBN 1-55558-339-3
	Principles of Incident Response and Disaster Recovery, 1st Edition, *Whitman/Mattord, CENGAGE Course Technology, 2007, ISBN 9781418836634*
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Type of Disasters			
2	Assessments and Security Certification including Computer AID tools			
3	Security Accreditation and Risk Acceptance and Management			
4	Control and Accountability	- *Organizational security procedures* - *Facility management* - *Software control* - *Hardware control* - *Backup*		
5	Business Goal and Contingency	- *Plan components* - *Response procedures* - *Destruction* - *On-site and off-site recovery and availability*		
6	Continuity Plan	- *Plan correction* - *Documentation* - *Security related specifications and documentations* - *Training*		
7	Test and Evaluation	- *Business Plan Measurement and testing* - *Security measurement and evaluation* - *Tooling and tools*		
8	Phases of Disaster Recovery and Business Continuity			

Silabus dan Satuan Acara Pengajaran (SAP) EL6114

Kode Matakuliah: EL6114	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Arsitektur dan Perancangan Keamanan
	Security Architecture and Design
Silabus Ringkas	
Silabus Lengkap	Contains the concepts, principles, structures and standards used to design, implement, monitor, and secure, operating systems, equipment, networks, applications, and those controls used to enforce various levels of confidentiality, integrity and availability. • Fundamental concepts of security models • Capabilities of information systems (e.g. memory protection, virtualization) • Countermeasure principles • Vulnerabilities and threats (e.g. cloud computing, aggregation, data flow control)
Luaran (Outcomes)	1. Demonstrate a high level of understanding of various concepts related to Systems security. 2. Demonstrate an understanding of concepts of Bus and Integrated Network security. 3. Analyze Side Channel and Fault attacks and countermeasures. 4. Evaluate system security against physical attacks. 5. Carry out a case study of Physical Security of Reconfigurable Hardware. 6. Create a physically secure reconfigurable hardware system.
Matakuliah Terkait	Introduction to Cryptography — Prasyarat
	Algebra for Cryptology — Prasyarat
Kegiatan Penunjang	
Pustaka	[1] *Cryptographic Algorithms on Reconfigurable Hardware* F. Rodriguez-Henriquez, N. A. Saqib, A. D. Perez, C. K. Koc *Springer* US (December 28, 2009)
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Intro to Modern Cryptography (1)	Secret Key Cryptography, Hash Functions, Public Key Cryptography, Digital Signature Schemes, Comparison of Public Key Cryptosystems, Cryptographic Security Strength		[1]
2	Intro to Modern Cryptography (2)	Potential Cryptographic Applications, Fundamental Operations for Cryptographic Algorithms, Desain Alternatives for Implementing Cryptographic Algorithms		[1]
3	Reconfigurable Hardware Technology (1)	FPGA (Xilinx, Altera), FPGA vs ASIC and General Purpose Processor Platforms, Reconfigurable Computing Paradigm		[1]
4	Reconfigurable Hardware Technology (2)	Implementation Aspects for Reconfigurable Hardware Designs, FPGA Architecture Statistics, Security in Reconfigurable Hardware Devices		[1]
5	Mathematical Background (1)	Number Theory, Finite Fields, Elliptic Curves		

6	Mathematical Background (2)	Elliptic Curves, Point Representation, Scalar Interpretation		[1]
7	Prime Finite Field Arithmetic	Addition Operation, Modular Addition Operation, Modular Multiplication Operation, Modular Exponentiation Operation,		[1]
8	Binary Finite Field Arithmetic	Field Multiplication, Field Squaring and Field Square Root for Irreducible Trinomials, Multiplicative Inverse, Other Arithmetic Operations		[1]
9	Reconfigurable Hardware Implementation of Hash Functions	Some famous hash functions, MD5, SHA, hardware architectures, recent hardware implementations		[1]
10	General Guidelines for Implementing Block Ciphers in FPGA	Block Cipher, DES, FPGA implementation of DES, other DES designs		[1]
11	Architectural Designs for the Advance Encryption Standard (1)	Rijndael Algorithm, AES		[1]
12	Architectural Designs for the Advance Encryption Standard (2)	Implementing AES to FPGA		[1]
13	Elliptic Curve Cryptography (1)	Hessian Form, Weierstras Non-Singular Form, Scalar Point Multiplication		[1]
14	Elliptic Curve Cryptography (2)	Implementing to Reconfigurable Hardware, Koblitz Curves		[1]

Silabus dan Satuan Acara Pengajaran (SAP) EL6115

Kode Matakuliah: EL6115	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Operasi Keamanan dan Insiden Response
	Security Operations & Incident Response
Silabus Ringkas	
Silabus Lengkap	
	Used to identify the controls over hardware, media and the operators with access privileges to any of these resources. • Resource protection • Incident response • Attack prevention and response • Patch and vulnerability management
Luaran (Outcomes)	
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Information Security Management Part 1	*Overview of information security management, confidentiality-integrity-availability (CIA) triad, non-repudiation, information classification*		
2	Information Security Management Part 2	*risk analysis and assessment, how policies, procedures, standards, baselines, guidelines define the security architecture, security planning, awareness programs*		
3	Security Architecture and Models	*Information protection environment, confidentiality and integrity models, protection mechanisms, security evaluation criteria, systems certification and accreditation.*		
4	Access Control and Methodology	*Information protection requirements and environment, security technology and tools, access control methodologies, information intrusion detection, analysis methods, authentication considerations*		
5	Application and Systems Development	*Software environment, software and system life cycle, system and software development methods, security in development methods, configuration management, information integrity, information accuracy and*		

		auditing.		
6	Operation Security Part 1	*Identify security events, alerting of proper authorities, understanding using types of controls,*		
7	Operation Security Part 2	*taking appropriate corrective or recovery actions, backups, data retention, redundancy, data handling, residual data, change management, policies and procedures.*		
8	Cryptography and PKI	*Basics of cryptography, ciphers, pki, etc. Where they are used and issues associated with using encryption.*		
9	Telecommunications/Network Security Management	*Operation overview, telecommunications/network environment, protection, network intrusion detection and remediation, vulnerabilities, access controls, securing the traffic, communication specific policies*		
10	Physical Security	*Electrical power and threats, environmental designs, inside and outside building security designs, vulnerability and penetration testing, fire suppression, physical controls.*		
11	Business Continuity/Disaster Recovery	*Business impact analysis, recovery strategies, policies/requirements, plan testing, plan maintenance, plan awareness and training, disaster recovery processes.*		
12	Security Incident Handling	*Security incidents, Incident response, detection, remediation*		
13	Law, Investigations and Ethics	*Licensing, intellectual laws, privacy laws, investigations, ethics*		

Silabus dan Satuan Acara Pengajaran (SAP) EL6116

Kode Matakuliah: EL6116	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Keamanan Database			
	Database Security			
Silabus Ringkas				
Silabus Lengkap	**Introduction:** introduction to Database security. **Access control and authentication:** access control policies, authentication options, password security, SQL extensions for security. **Securing databases connectivity:** secure architectures, schema and policy integration, migration of databases and applications. **Auditing databases:** auditing architectures, auditing functions, auditing SQL statements, auditing intrusion detection. **Encryption:** encryption functions, key management, encrypting SQL server data and network traffic, applications.			
Luaran (Outcomes)	5. Understand the importance of secure database systems. 6. Identify major database security issues. 7. Devise appropriate policies for access control and authentication. 8. Discuss security issues in database connectivity. 9. Justify the need for auditing databases.			
Matakuliah Terkait	Information Security Management	Prasyarat		
	Introduction to Cryptography	Prasyarat		
Kegiatan Penunjang				
Pustaka	*Implementing Database Security and Auditing: Includes Examples for Oracle, SQL Server, DB2 UDB, Sybase* Ron Ben Natan *Elsevier. 2005*			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction:** introduction to Database security.			
2	**Access control and authentication:** access control policies, authentication options, password security, SQL extensions for security.			
3	**Securing databases connectivity:** secure architectures, schema and policy integration, migration of databases and applications.			
4	**Securing databases connectivity:** schema and policy integration, migration of databases and applications.			
5	**Auditing databases:** auditing architectures, auditing functions.			
6	**Auditing databases:** SQL statements, auditing intrusion detection.			
7	**Encryption:** encryption functions, key management.			
8	**Encryption:** encrypting SQL server data and network traffic, applications.			
9				

Silabus dan Satuan Acara Pengajaran (SAP) EL6117

Kode Matakuliah: EL6117	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Keamanan Mobile/Nir-kabel
	Mobile / wireless security

Silabus Ringkas	

Silabus Lengkap	**Introduction:** Introduction to Wireless Mobile Systems and Network Architectures. **Wireless Security Threats:** Identity theft, Mobile fraud, Spoofing, Channel Hijack, Other threats. **Wireless LAN Technology:** Overview, Infrared LANs, Spread Spectrum, Narrowband Microwave. **Wi-Fi and the IEEE 802.11 Wireless Lan standard:** Protocol architecture, Services, MAC Layer, Physical Layer, Wi-Fi protected Access. **WLAN Security Standard IEEE802.11i:** Wireline Equivalent Privacy (WEP), Wi-Fi Protected Access(WPA), Extensible Authentication Protocol (EAP), Counter-Mode/CBC-MAC Protocol (CCMP), IEEE 802.1x, EAP encapsulation over LANs (EAPOL), Security Requirements and Threats, Emerging Security Standards and Technologies. **Wireless PAN:** Overview, Radio specification, Baseband specification, Link manager protocol, Logical link control and adaptation protocol. **Wireless PAN Security:** Security of Bluetooth, Security requirements and threats, Risk mitigation, Security check list, Ad Hoc network risk. **RFID/USN Security:** Overview, Specifications, Security requirements, Security standards, Mutual authentications protocols. **Mobile Security Fundamentals:** Transmission security, secured subscriber identification, mobile device identification, basic GSM, WAP and 3GPP security mechanisms, Research directions in security and privacy, Challenges related to mobility, SIM/USIM card security, Pin code, Mobile network security, GSM and 3G security. **Third Generation Security:** Security principles, Algorithms, Architectures, Objectives, Problems. **Mobile Ad hoc Networks:** Overview, Peer to Peer, Routing security, Authentication and New MANET Security Protocols. **Emerging Topics:**, E-Commerce Security, M-Commerce Security, Authentication and Protocols M-Voting, Encryption mobile/AES, Cryptography for mobile security, Location Based Service Security, Security Challenges, Anonymity Protocol, Mobile Agents Security.

Luaran (Outcomes)	At the completion of the course, student should be able to: 1. Identify security mechanisms in wireless networks and cellular systems. 2. Identify sources of security threats in WLAN, WPAN, GSM, and 3G. 3. Evaluate the strength of various data security protocols. 4. Design standard authentication and secrecy mechanisms for wireless and cellular mobile communication environments.

Matakuliah Terkait	Introduction to Cryptography	Prasyarat
	Computer and Network Security	Prasyarat

Kegiatan Penunjang	

Pustaka	*Wireless Communications & Networks* William Stallings, Prentice Hall, 2nd Edition, 2005
	Wireless Security – Models, Threats, and Solutions Nichols and Lekkas, McGraw-Hill, 2002
	UMTS Security Valtteri Niemi and Kaisa Nyberg Wiley, 2003

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction: Syllabus, Wireless Basics	*Basic Terms; Antennas and Propagations; Encoding, Spread Spectrum Technology.*		
2	802.11 Standards: PHY, MAC, and Security (WEP, WPA, 802.1x, RSN, 802.11i, and etc).	*Security Basics Review; Wireless Attacks and Defense.*		
3	802.11 Network Troubleshooting, Performance Tuning, and Security Enhancement.	*- Rate Adaptations; QoS Provisioning (802.11e); Power Management; b/g Mixed-Mode performance analysis; Wireless TCP; Enterprise 802.11 Network Analysis;*		

		- Deployment Issues in Enterprise 802.11 based Wireless LANs; 802.11 Self-Management (channel assignments, transmission power, fragmentation, and etc); - Network Fault Diagnosis (PHY and MAC); Greedy Behavior Detection; Mobile Device Privacy.	
4	Mobile IP	*Roaming; Handoff (including Vertical handoff); Mobility management; Location and context-aware mobile applications and services; SCTP.*	
5	Wireless Ad Hoc and Mesh Networks	*Wireless ad hoc networks. A tutorial on Mobile Ad Hoc Networks: Routing, MAC and Transport Issues.*	
6	Cellualr Networks; Wireless Metropolitan Area Network (WMAN); Wireless Wide Area Network (WWAN)	*HSDPA, 3G, or WiMAX*	
7	Wireless Personal Area Network (WPAN)	*Bluetooth and Zigbee.*	
8	RFID		
9	Course Review and Project Presentation		

Silabus dan Satuan Acara Pengajaran (SAP) EL6118

Kode Matakuliah: EL6118	Bobot sks: 3	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Information warfare			
	Information warfare			
Silabus Ringkas				
	This course is a study of the emerging area of Information Warfare (IW). Stress will be on developing and then comparing and contrasting two themes: IW in support of traditional counter C4I doctrine and IW as a new type of cyberspace conflict involving computers and networks.			
Silabus Lengkap				
Luaran (Outcomes)	Upon completion of this course, the student will be able to: 1. Describe and apply the key concepts and basic role of information operations (IO) 2. in modern warfare. 3. Explain and debate the current concepts and theories of information science/information - based warfare. 4. Derive and apply a functional taxonomy based upon IO objectives. 5. Explain and discuss the key elements of IO 6. Examine and apply numerous methods of implementing offensive IO in the modern battle space 7. Evaluate and apply the numerous methods of implementing defensive IW in the modern battle space. 8. Compare/contrast and discuss the various IW doctrine used by the services. 9. Describe and evaluate the key concepts pertaining to electronic warfare (EW). 10. Explain and discuss the key elements of an Integrated Air Defense System (IADS). 11. Write a carefully done original, graduate level research paper in this field; and support the statements and conclusion(s) with properly documented evidence.			
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	Joint Chiefs of Staff. JP 3 - 13, Information Operations. 13 February 2006.			
	Kopp, Carlo. "Desert Storm: The Electronic Battle." Australian Aviation, June/July/August, 1993			
	Waltz, Edward. Information Warfare: Principles and Operations. Artech House, 1998.			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			
2	Models of Information Warfare			
3	Strategy			
4	Defensive Technology			
5	Understanding Attackers			
6	Recognizing Attacks			
7	**Midterm**			
8	Physical Attacks			
9	Cyber Attacks			
10	The Future of Information Warfare			
11	Additional Topics 1			
12	Additional Topics 2			
13	Additional Topics 3			
14	**Final Exam**			

Silabus dan Satuan Acara Pengajaran (SAP) EL6119

Kode Matakuliah: EL6119	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Devais Keamanan
	Security Devices

Silabus Ringkas	

Silabus Lengkap	Although security is prevalent in PCs, wireless communications and other systems today, it is expected to become increasingly important and widespread in many embedded devices. For some time, typical embedded system designers have been dealing with tremendous challenges in performance, power, price and reliability. However now they must additionally deal with definition of security requirements, security design and implementation. Given the limited number of security engineers in the market, large background of cryptography with which these standards are based upon, and difficulty of ensuring the implementation will also be secure from attacks, security design remains a challenge. This book provides the foundations for understanding embedded security design, outlining various aspects of security in devices ranging from typical wireless devices such as PDAs through to contactless smartcards to satellites.

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	Catherine H. Gebotys, Security in Embedded Devices (Embedded Systems), Springer, 2009

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction to Secure Embedded Systems**			
2	**The Key**			
3	**Using Keys**			
4	**Elliptic Curve Protocols**			
5	**Symmetric Key Protocols Including Ciphers**			
6	**Data Integrity and Message Authentication**			
7	**Side Channel Attacks on the Embedded System**			
8	**Countermeasures**			
9	**Reliable Testable Secure Systems**			
10				
11				
12				
13				
14				

Silabus dan Satuan Acara Pengajaran (SAP) EL6120

Kode Matakuliah: EL6120	*Bobot sks:* 3	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Aljabar Kriptologi
	Algebra for Cryptology

Silabus Ringkas	
	To provide the student with notions of algebraic structures to work in the field of Cryptology and Information Assurance.

Silabus Lengkap	
	Linear Algebra: Matrices, Determinants, Linear Systems of Equations, Vector Spaces, Linear Codes. Group theory: Definition of a group, Examples: cyclic, dihedral, symmetric, matrix groups, Homomorphisms, Subgroups and quotient groups, Cosets, Conjugacy classes, Normal subgroups, Lagrange's theorem The isomorphism theorems, Symmetric group and alternating group. Field theory: Basic definition of Field, Binary Finite Field. Primitive polynomials: Definition and Construction.

Luaran (Outcomes)	1. Understand basic Groups and group operations 2. Understand Field operations and Field algebra 3. Apply Field Algebra to required fields in Cryptography 4. Analyze operations with primitive polynomials 5. Create primitive polynomials on finite fields 6. Understand Linear algebra and Vector spaces 7. Apply Linear Algebraic techniques to Linear Codes

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	[1] Abstract Algebra, I. N. Herstein, John Wiley & Sons; 3rd edition (2004)
	[2] Linear Algebra, Kenneth Hoffman, Prentice Hall; 3 Sub edition (August 2010)
	[3] Abstract Algebra, David S. Dummit and Richard M. Foote, Wiley, 3 Edition (2003)

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction	Set Theory, Mappings, Integers, Mathematical Induction, Complex Numbers		[1]
2	Linear Equations	Matrices, Matrix Multiplication, Invertible Matrices		[2]
3	Vector Spaces	Vector Spaces, Subspaces, Bases and Dimension		[2]
4	Linear Transformations	Isomorphism, Representation of Transformations by Matrices, Linear Functionals, Double Dual, Transpose of a Linear Transformation		[2]
5	Polynomials and Determinants	Algebras of Polynomials, Lagrange Ideals, Prime Factorization of a Polynomial, Commutative Rings, Determinant Functions		[2]
6	Elementary Canonical Forms & The Rational and Jordan Forms	Annihilating Polynomials, Invariant Subspaces, Triangulations, Diagonalization, Cyclic Subspaces, Cyclic Decomposition, The Jordan Form		[2]
7	Inner Product Spaces & Operators	Linear Functionals and Adjoints, Unitary Operators, Normal		[2]

		Operators, Spectral Theory		
8	Bilinear Forms	Symmetric Bilinear Forms, Skew-Symmetric Bilinear Forms, Group Preserving Bilinear Forms		[2]
9	Group Theory	Introduction to Groups, Subgroups, Quotient Group dan Homomorphism, Group Actions, Direct and Semidirect Products and Abelian Groups		[1][3]
10	Ring Theory	Introduction to Rings, Euclidean Domains, Principal Ideal Domains and Unique Factorization Domains, Polynomial Rings		[1][3]
11	Modules and Vector Spaces	Introduction to Module Theory, Vector Spaces, Modules over Principal Ideal Domains		[3]
12	Field Theory and Galois Theory	Field Theory, Galois Theory		[1][3]
13	Intro to Commutative Rings, Algebraic Geometri and Homological Algebra	Commutative Rings and Algebraic Geometry, Artinian Rings, Discrete Valuation Rings and Dedekind Domains, Intro to Homological Algebra and Group Cohomology		[3]
14	Introduction to The Representation Theory of Finite Groups	Representation Theory and Character Theory, Examples and Applications		[3]

Silabus dan Satuan Acara Pengajaran (SAP) EL6121

Kode Matakuliah: EL6121	*Bobot sks:* **3**	*Semester:* Ganjil	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Sistem Pendukung Keputusan
	Decision Support Systems
Silabus Ringkas	
Silabus Lengkap	
	Decision-support systems (DSS) support management decision-making in a business environment. Its focus is to provide viable alternatives for managers rather than replacing judgment with an optimized solution. General topics covered include theories of organization, decision theories, inferential process, information systems, DSS software and hardware and model building.
Luaran (Outcomes)	This course provides an overview of Decision Support Systems (DSS)/Business Intelligence (BI), and some of the areas that they have been used successfully. The expected outcomes are: 1. To introduce the development of decision support or business intelligence, and expert systems as both academic fields and as commercially viable software systems for use to support, and to automate business decision making. 2. To enable students to acquire an understanding of the basic concepts and skills associated with decision theory and the modeling of business decisions. 3. To enable students to recognize the different classes of decision support systems or business intelligence, expert systems, and to appreciate the different settings in which these may be used to best effect. 4. To enable the student to appreciate the role and nature of Group Decision Support Systems and related approaches such as Cognitive Mapping as a means of structuring and supporting complex unstructured decision problems with high levels of uncertainty. 5. To appreciate how different forms of computer system support the operation and deployment of decision support systems within organizations, and to understand how contemporary developments in Web technology are allowing these developments to diffuse into many other applications. 6. To understand and appreciate how the fields of expert systems and artificial intelligence have evolved from earlier work in decision support systems.
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Decision Support and Business Intelligence Systems, 8th Edition Efraim Turban, University of Hawaii Jay E. Aronson, University of Georgia Ting-Peng Liang, National Sun Yat-Sen University Ramesh Sharda, Oklahoma State University Publisher: Prentice Hall
Panduan Penilaian	
Catatan Tambahan	

Mg#	*Topik*	*Sub Topik*	*Capaian Belajar Mahasiswa*	*Sumber Materi*
1	Decision Support Systems and Business Intelligence			Chapters 1
2	Decision Making, Systems, Modeling, and Support Decision Support Systems Concepts, Methodologies, and Technologies: An Overview			Chapters 2,3
3	Modeling and Analysis			Chapters 4
4	Data Warehousing Business Analytics and Data Visualization			Chapters 5,6
5	Data, Text, and Web Mining			Chapters 7
6	Neural Networks for Data Mining			Chapters 8
7	Business Performance Management			Chapters 9

8	Collaborative Computing-Supported Technologies and Group Support Systems			Chapters 10
9	Knowledge Management			Chapters 11
10	Artificial Intelligence and Expert Systems			Chapters 12
11	Advanced Intelligent Systems			Chapters 13
12	Intelligent Systems over the Internet			Chapters 14
13	Systems Development and Acquisition			Chapters 15
14	Integration, Impacts, and the Future of Management Support Systems			Chapters 16

Silabus dan Satuan Acara Pengajaran (SAP) EL6201

Kode Matakuliah: EL6201	*Bobot sks:* 3	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Sistem Paralel
	Parallel System

Silabus Ringkas	

Silabus Lengkap	This course provides an in-depth study of the design, engineering, and evaluation of modern parallel computers. It begins with an overview of the field focusing on the convergence of many diverse architectural approaches around the communication architecture. It extracts fundamental design issues: naming, replication, synchronization, latency, overhead, and bandwidth and explores these across the spectrum of modern machines. A sound basis is built up in workload-driven evaluation, with a brief overview of parallel programming. It studies small-scale shared memory multiprocessors in some detail to lay a groundwork for understanding large-scale designs. It then examines scalable multiprocessors throughly, including realizing programming models via network transactions, directory-based cache coherence, interconnection network design, software-based virtual shared memory, COMA techniques, and latency tolerance through multithreading and other means.

Luaran (Outcomes)	

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	Vipin Kumar, Ananth Grama, Anshul Gupta, George Karypis, "Introduction to Parallel Computing", Second Edition, Addison Wesley, 2003 (1)
	David E. Culler, Jaswinder Pal Singh, Anoop Gupta, "Parallel Computer Architecture: A Hardware/Software Approach", Morgan Kaufmann, 1998.

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction to Parallel Computing	Motivating Parallelism, Scope of Parallel Computing, Organization and Contents of the Text		(1) Chapter 1
2	Parallel Programming Platforms	Implicit Parallelism: Trends in Microprocessor Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms		(1) Chapter 2
3	Parallel Programming Platforms	Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process-Processor Mapping and Mapping Techniques		(1) Chapter 2
4	Principles of Parallel Algorithm Design	Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions		(1) Chapter 3
5	Principles of Parallel Algorithm Design	Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models		(1) Chapter 3
6	Basic Communication Operations	One-to-All Broadcast and All-to-One Reduction,		(1) Chapter 4

		All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift		
7	Analytical Modeling of Parallel Programs	Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance		(1) Chapter 5
8	Programming Using the Message-Passing Paradigm	Principles of Message-Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface		(1) Chapter 6
9	Programming Using the Message-Passing Paradigm	Topologies and Embedding, Overlapping Communication with Computation		(1) Chapter 6
10	Programming Using the Message-Passing Paradigm	Collective Communication and Computation Operations, Groups and Communicators		(1) Chapter 6
11	Programming Shared Address Space Platforms	Thread Basics, The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads		(1) Chapter 7
12	Dense Matrix Algorithms	Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Solving a System of Linear Equations		(1) Chapter 8
13	Sorting	Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort		(1) Chapter 9
14	Graph Algorithms	Definitions and Representation, Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Algorithms for Sparse Graphs		(1) Chapter 10
15	Search Algorithms for Discrete Optimization Problems	Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms		(1) Chapter 11

Silabus dan Satuan Acara Pengajaran (SAP) EL6202

Kode Matakuliah: EL6202	*Bobot sks:* 3	*Semester:* Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Sistem dan Teknologi Sensor
	Sensor Technology and System

Silabus Ringkas	Tinjauan teknologi dan sistem sensor; transduser; kinerja sensor; sensor mekanik dan termal; sensosr radian, magnetic dan kimia; bahan dan proses fabrikasi sensor; sistem akuisisi data; rangkaian elektronik antar-muka; jaringan sensor nirkabel
	Overview on sensor technology and system; transducers; sensor performance; mechanical and thermal sensors; radiant, magnetic and chemical sensors; sensor materials and fabrication process; data acquisition system; interface electronic circuits; wireless sensor networks

Silabus Lengkap	Tinjauan teknologi dan sistem sensor, sensor pasif dan aktif, absolute dan relatif. Domain sinyal, elemen transduser, transduksi tandem, matrik efek transduksi. Sensitivity, range, linearity, offset, selectivity, repeatability, hysteresis, noise, Signal-to-Noise, resolution, response time, drift, stability, overload characteristic, power consumption. Motion, position, level, and flow, velocity, acceleration, and vibration. Pressure, temperature, and humidity. Light, radiation, and magnetism, chemical and bio-chemical. Sensor materials, surface processing, nano-technology. Sensor, interface, excitation circuits, multiplexer, ADC. Signal amplification signal conditioning, and data processing. Data readout, data transmission, power circuits, noise. Introduction to wireless sensor networks, network architectures and protocol stack, sensing capacity of sensor networks, detection in sensor networks. Medium access control, routing and data dissemination, node clustering. Body sensor networks, biosensor design and interfacing, protein engineering for biosensors. Sensor network standards, future trends in wireless sensor networks
	Overview on sensor technology and system, passive and active, absolute and relative sensors. Signal domains of input and output, transducer elements, tandem transduction, matrix of transduction effect. Sensitivity, range, linearity, offset, selectivity, repeatability, hysteresis, noise, Signal-to-Noise, resolution, response time, drift, stability, overload characteristic, power consumption. Motion, position, level, and flow, velocity, acceleration, and vibration. Pressure, temperature, and humidity. Light, radiation, and magnetism, chemical and bio-chemical. Sensor materials, surface processing, nano-technology. Sensor, interface, excitation circuits, multiplexer, ADC. Signal amplification signal conditioning, and data processing. Data readout, data transmission, power circuits, noise. Introduction to wireless sensor networks, network architectures and protocol stack, sensing capacity of sensor networks, detection in sensor networks. Medium access control, routing and data dissemination, node clustering. Body sensor networks, biosensor design and interfacing, protein engineering for biosensors. Sensor network standards, future trends in wireless sensor networks

Luaran (Outcomes)	Setelah mengikuti kuliah ini dengan penuh, mahasiswa mampu : - memahami teknologi sensor - memahami sistem sensor - memahami jaringan sensor nirkabel

Matakuliah Terkait	.	.
	.	.

Kegiatan Penunjang	Sensor System Design Project

Pustaka	Jacob Fraden: Handbook of Modern Sensors : Physics, Designs, and Applications 3rd ed., Springer-Verlag, Inc. 2003. ISBN: 0-387-00750-4
	Jon S. Wilson (ed): Sensor Technology Handbook, Elsevier Inc. 2005. ISBN: 0-7506-7729-5
	Guang-Zhong Yang (ed): Body Sensor Networks, Springer, 2006. ISBN: 1-84628-272-1
	Ananthram Swami et.al. (ed): Wireless Sensor Networks – Signal Processing and Communication Perspectives, John Wiley & Sons., 2007. ISBN: 978-0-470-03557-3
	Jun Zheng et.al. (ed): Wireless Sensor Networks – A Networking Perspective, John Wiley & Sons., 2009. ISBN: 978-0-470-16763-2

Panduan Penilaian	Tugas/Kuis/PR 20% Sensor System Project (Design Report) 25% UTS (Sensor Technology Theory) 25% UAS (Project Presentation) 30%

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Sensor overview	Overview on sensor technology and system, passive and active, absolute and relative sensors.	To know a general overview on sensor technology and system. To understand type of sensors.	Jon S. Wilson, Bab 1, 2
2	Transducers	Signal domains of input and output, transducer elements, tandem transduction, matrix of transduction effect	To understand signal domains of input and output, transducer elements, tandem transduction, matrix of transduction effect.	Jacob Fraden, Bab 3
3	Sensor performance	Sensitivity, range, linearity, offset, selectivity, repeatability, hysteresis, noise, Signal-to-Noise, resolution,	To understand sensitivity, range, linearity, offset, selectivity, repeatability, hysteresis, noise, Signal-to-Noise, resolution, response time, drift, stability,	Jacob Fraden, Bab 2

		response time, drift, stability, overload characteristic, power consumption	overload characteristic, power consumption.	
4	Mechanical and thermal sensors	Motion, position, level, and flow, velocity, acceleration, and vibration.	To overview sensors of motion, position, level, and flow, velocity, acceleration, and vibration.	Jacob Fraden, Bab 6-11
5	Mechanical and thermal sensors	Pressure, temperature, and humidity	To overview sensors of pressure, temperature, and humidity	Jacob Fraden, Bab 13, 16
6	Radiant, magnetic and chemical sensors	Light, radiation, and magnetism, chemical and bio-chemical	To overview sensors of light, radiation, and magnetism, chemical and bio-chemical.	Jacob Fraden, Bab 14, 15, 17
7	Sensor materials and fabrication process	Sensor materials, surface processing, nano-technology.	To understand sensor materials, surface processing, nano-technology.	Jacob Fraden, Bab 18
8	UTS			
9	Data Acquisition System	Sensor, interface, excitation circuits, multiplexer, ADC	To know function of interface, excitation circuits, multiplexer, ADC.	Jacob Fraden, Bab 1
10	Interface Electronic Circuits – 1	Signal amplification signal conditioning, and data processing.	To understand signal amplification signal conditioning, and data processing.	Jacob Fraden, Bab 5 Jon S. Wilson, Bab 4
11	Interface Electronic Circuits – 2	Data readout, data transmission, power circuits, noise.	To study data readout, data transmission, power circuits, noise.	Jacob Fraden, Bab 5
12	Wireless sensor networks – 1	Introduction to wireless sensor networks, network architectures and protocol stack, sensing capacity of sensor networks, detection in sensor networks.	To understand concept of wireless sensor networks. To learn network architectures and protocol stack, sensing capacity of sensor networks, detection in sensor networks.	Jun Zheng, Bab 1, 2 Ananthram Swami, Bab 4, 6
13	Wireless sensor networks – 2	Medium access control, routing and data dissemination, node clustering.	To study medium access control, routing and data dissemination, node clustering.	Jun Zheng, Bab 3, 4, 6
14	Wireless sensor networks – 3	Body sensor networks, biosensor design and interfacing, protein engineering for biosensors.	To study body sensor networks, biosensor design and interfacing, protein engineering for biosensors.	Guang-Zhong Yang, Bab 1, 2, 3
15	Wireless sensor networks – 4	Sensor network standards, future trends in wireless sensor networks.	To discuss sensor network standards, future trends in wireless sensor networks.	Jun Zheng, Bab 13, 14

Silabus dan Satuan Acara Pengajaran (SAP) EL6203

Kode Matakuliah: EL6203	Bobot sks: 2	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	MEMS/Devais Lanjut			
Silabus Ringkas				
Silabus Lengkap	This course is an introduction to MEMS intended for graduate and senior students. Silicon-based integrated MEMS promise reliable performance, miniaturization and low-cost production of sensors and actuator systems with broad applications in data storage, biomedical systems, inertial navigation, micromanipulation, optical display and microfluid jet systems. The course covers such subjects as materials properties, fabrication techniques, basic structure mechanics, sensing and actuation principles, circuit and system issues, packaging, calibration and testing.			
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka	Fundamentals of Microfabrication, Marc Madou, CRC Press, 1997			
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Fundamentals and limitations of photolithography			
2	Pattern transfer with etching techniques			
3	Pattern transfer with other physical and chemical techniques			
4	Bulk micromachining			
5	Surface micromachining			
6	Other micromachining techniques			
7	Packaging techniques			
8	Microscaling considerations			
9	Applications in automotive industry			
10	Applications in biomedical industry			
11	Future developments			
12				
13				
14				
15				

Silabus dan Satuan Acara Pengajaran (SAP) EL6204

Kode Matakuliah: EL6204	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Keamanan Web dan E-Bussiness
	Web and E-Business Security
Silabus Ringkas	
Silabus Lengkap	**Introduction:** Web Architecture, Network Security Vs. Application Security, SSL and secure connections, proxy servers and application firewalls **Web Server Security:** Server-side structure, Web Authentication, Session management **Content Security:** database drivers and connectivity, efficient database access **E-Business Security:** lifecycle of electronic transactions, electronic payment systems, interoperability **Digital Certificates:** digital identification techniques, certificate authorities, client-side digital certificates, code signing **E-Business Continuity:** auditing and penetration testing, incident response, disaster recovery, contingency planning **Legal and Privacy Issues of E-Business.**
Luaran (Outcomes)	1. Understand various Web security threats. 2. Justify the need for a secure Web environment. 3. Assess different Web server security approaches. 4. Analyze different digital payment systems. 5. Discuss digital certification and identification methods. 6. Identify the security issues of an e-business system
Matakuliah Terkait	Introduction to Cryptography — Prasyarat
	Information Security Management — Prasyarat
Kegiatan Penunjang	
Pustaka	*Security Technologies for the World Wide Web* Rolf Oppliger Artech House, 2nd edition, 2003
	Web Security, Privacy and Commerce Simson Garfinkel, Gene Spafford, O'Reilly, 2nd edition, 2002
	Web Hacking Attacks and Defenses Stuart McClure, Saumil Shah, Shreeraj Shah Addison-Wesley 2002
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction:** Web Architecture, Network Security Vs. Application Security			
2	**Introduction:** SSL and secure connections, proxy servers and application firewalls			
3	**Web Application Attacks:** Common attacks on Web Applications			
4	**Web Server Security:** Server-side structure, Web Authentication			
5	**Web Server Security:** Session management, cookies, hidden-form fields, URL rewriting**.**			
6	**Content Security:** Database drivers and connectivity, efficient database access			
7	**E-Business Security:** Lifecycle of electronic transactions			
8	**E-Business Security:** Electronic payment systems,			

	interoperability			
9	**Digital Certificates:** Digital identification techniques, certificate authorities			
10	**E-Business Continuity:** Auditing and penetration testing, incident response,			
11	**E-Business Continuity:** Disaster recovery, contingency planning			
12	**Legal Issues of E-Business**			
13	**Privacy Issues**			
14	**Student Presentations**			

Silabus dan Satuan Acara Pengajaran (SAP) EL6205

Kode Matakuliah: EL6205	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Malware
	Malware
Silabus Ringkas	
Silabus Lengkap	This course provides students with an effective immersion into the realm of Malware Analysis and Reverse Engineering. It follows a progressive approach that introduces relevant concepts and techniques while preparing students to become effective malware analysts that can use a standard methodology for detecting, analyzing, reverse engineering and eradicating malware
Luaran (Outcomes)	This course will equip students with the necessary background knowledge in order to become effective M alware Analysis & Reverse Engineering practitioners. Upon successful completion of this course, students should be able to: 1. Develop a good understanding of Malware Analysis. 2. Identify the different types of Malware Analysis methods. 3. Gain a broad exposure to real world applications of Malware Analysis. 4. Set up a relatively inexpensive lab for Malware Analysis activities. 5. Utilize a standard methodology for detecting, analyzing, reverse engineering, and eradicating malware. 6. Use a Malware Analysis - based approachin order to resolve real world problems. 7. Recognize common malware characteristics. 8. Bypass some of the advanced malware techniques, such as packing, obfuscation and anti -analysis of armored malware breeds
Matakuliah Terkait	
Kegiatan Penunjang	
Pustaka	Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code, First Edition (2010)
	Malware: Fighting Malicious Code: Ed Skoudis and Lenny Zeltser (2003)
	Malware Forensics: Investigating and Analyzi ng Malicious Code: Cameron H. Malin, Eoghan Casey, and James M. Aquilina (2008)
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Basic Analysis	- Basic Static Techniques - Malware Analysis in Virtual Machines - Basic Dynamic Analysis		
2	Advanced Static Analysis Part 1	- A Crash Course in x86 Disassembly - IDA Pro		
3	Advanced Static Analysis Part 2	- Recognizing C Code Constructs in Assembly - Analyzing Malicious Windows Programs		
4	Advanced Dynamic Analysis	- Debugging - OllyDbg - Kernel Debugging with WinDbg		
5	Malware Functionality Part 1	- Malware Behavior - Covert Malware Launching		
6	Malware Functionality Part 2	- Data Encoding - Malware-Focused Network Signatures		
7	Anti-Reverse-Engineering Part 1	- Anti-Disassembly - Anti-Debugging		
8	Anti-Reverse-Engineering Part 2	- Anti-Virtual Machine Techniques		

		- *Packers and Unpacking*		
9	Special Topic Part 1	*Shellcode Analysis*		
10	Special Topic Part 2	*C++ Analysis*		
11	Special Topic Part 3	*64-Bit Malware*		

Silabus dan Satuan Acara Pengajaran (SAP) EL6206

Kode Matakuliah: EL6206	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Teori Bilangan
	Number Theory

Silabus Ringkas	
	Number Theory: Properties of Integers, Divisibility, Prime Numbers, Factorization, Congruence, Wilson Theorem, Fermat Theorem, Diophantine Equations, Euler's Theorem, Quadratic Residue, Discrete Logarithm.

Silabus Lengkap	

Luaran (Outcomes)	On completion of this course the student will be able to: 1. Understand basics of Abstract Algebra 2. Understand various number theoretic concepts. 3. Apply results from number theory to information security and cryptography 4. Understand basics of Probability and Statistics 5. Analyze probabilistic notions associated with information security and cryptography 6. Apply statistical methods to information security and cryptographic use

Matakuliah Terkait		

Kegiatan Penunjang	

Pustaka	*A First Course in Abstract Algebra* John Fraleigh Addison Wesley 7 edition
	Elementary Number Theory David M. Burton McGraw Hill, 6 Edition (2005)
	Basic Probability Theory Robert B. Ash Dover Publications (2008)

Panduan Penilaian	

Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction: Set Theory, Polynomials			
2	Introduction to Number Theory: Properties of Integers, Divisibility, Mathematical Induction			
3	Prime Numbers, Factorization, Congruence			
4	Diophantine Equations, Chinese Remainder Theorem			
5	Fermat Theorem, Euler's Theorem, Wilson's Theorem			
6	Quadratic Residue, Discrete Logarithm, Legendre Symbol			
7	Algebra: Groups, subgroups			
8	Rings, Ideal, Maximal Ideal			
9	Basic definition of Field			
10	Binary Finite Field			
11	Introduction to Probability: Events, Probability space			

12	Random variables, expectation, variance, moments			
13	Discrete Distributions			
14	Continuous Distributions			

Silabus dan Satuan Acara Pengajaran (SAP) EL6207

Kode Matakuliah: EL6207	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Kriptanalisis
	Cryptanalysis
Silabus Ringkas	
Silabus Lengkap	**Introduction:** Review of Cryptanalysis of Classical ciphers (Transposition, Substitution, Vigenere etc.). **Linear Cryptanalysis:** Attack on DES. **Differential Cryptanalysis:** Attack on DES. **Fast Correlation attacks:** Attacks on Combiner Models. **Algebraic attacks:** Attack on AES. **Factoring:** Attack on RSA. Trial Division, Quadratic Sieve, Number Field Sieve. **Attacks on DLP:** Index Calculus. **Side Channel Attacks**
Luaran (Outcomes)	1. Understand concepts of security. 2. Identify and assess security vulnerabilities. 3. Analyze different cryptanalytic models and their applications. 4. Understand the state-of-the-art cryptanalysis schemes. 5. Evaluate the future of cryptanalysis and secure ciphers. 6. Devise new attacks based on the learning.
Matakuliah Terkait	Introduction to Cryptography — Prasyarat
	Algebra for Cryptology — Prasyarat
Kegiatan Penunjang	
Pustaka	*Introduction to Modern Cryptography: Principles and Protocols* Jonathan Katz and Yehuda Lindell Chapman and Hall/CRC; 1 edition (31 Aug 2007)
	Introduction to Cryptography with Coding Theory Wade Trappe and Lawrence C. Washington Prentice Hall; 2 edition (July 25, 2005)
	A Computational Introduction to Number Theory and Algebra V. Shoup Cambridge University Press 2007
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction:** Review of classical ciphers and basic attacks. Transposition, Vigenere, Poly-alphabetic , Substitution ciphers			
2	**Formal Approach:**defining security, the importance of precise definitions, proofs by reduction			
3	**Formal Approach:** indistinguishable encryptions, relation to semantic security, perfect secrecy and computational security, definition of CPA-security			
4	**Basic Cryptanalysis:** Attacks on reduced-round substitution-permutation networks			
5	**Linear Cryptanalysis:** basic concepts and the piling-up lemma. Attack on simplified substitution-permutation network.			
6	**Linear Cryptanalysis:** Attack on simplified substitution-permutation network.			
7	**Differential Cryptanalysis:**			

Bidang Akademik dan Kemahasiswaan ITB	**Kur2013-S2-EL**	**Halaman 138 dari 159**

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	basic concepts. Attack on simplified substitution-permutation network			
8	**Differential Cryptanalysis:** Attack on simplified substitution-permutation network			
9	**Stream Cipher attacks:** known plaintext attacks on LFSR, basic concepts of correlation attacks on non-linear filter and non-linear generator systems			
10				
11	**Factoring:** Attack on RSA. Trial Division. Concepts of Sieving. Quadratic Sieve, Number Field Sieve.			
12	**Attacks on Textbook RSA:** low exponent, common modulus etc			
13	**Attacks on DLP:** Index Calculus etc.the basic 3-pass protocol and meet in the middle attacks			
14	**Attacks on authentication mechanisms:**Definition of security for authentication systems, building a secure variable-length hash function, collision resistance, birthday attacks			
15	**Attacks on Textbook RSA Signatures:** forging signatures for textbook RSA			

Silabus dan Satuan Acara Pengajaran (SAP) EL6208

Kode Matakuliah: EL6208	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Keamanan Embedded
	Embedded Security
Silabus Ringkas	
Silabus Lengkap	**Introduction:** Digital System design, overview of VHDL. **Cryptography:** Basic building blocks. **Mathematical Preliminaries:** Binary Finite Field Arithmetic. **Arithmetic Blocks:** Design of Binary Finite Field computation units. **Cryptographic Blocks:** Implementation of Hash Functions: SHA. Block Cipher hardware design: AES. Asymmetric cryptographic hardware design: RSA.
Luaran (Outcomes)	1. Demonstrate a high level of understanding of various concepts related to Systems design. 2. Demonstrate a high level of understanding of the concepts of Basic Cryptographic Modules. 3. Analyze the construction of Cryptographic Hardware. 4. Evaluate Hardware security for practical systems. 5. Case study of three different Cryptographic system design. 6. Create and analyze secure hardware systems.
Matakuliah Terkait	Introduction to Cryptography	Prasyarat
	Algebra for Cryptology	Prasyarat
Kegiatan Penunjang	
Pustaka	[1] *VHDL Made Easy!* David Pellerin, Douglas Taylor Prentice Hall PTR, 1997
	[2] *Hardware Implementation of Finite-Field Arithmetic* Jean-Pierre Deschamps, Jose Luis Imana, Gustavo D. Sutter
	[3] *Cryptographic Algorithms on Reconfigurable Hardware* F. Rodriguez-Henriquez, N. A. Saqib, A. D. Perez, C. K. Koc Springer US (December 28, 2009)
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Introduction:** overview of VHDL.	What is VHDL, history of VHDL, FPGA/ASIC Design Process, VHDL data types and structures		[1]
2	VHDL	Exploring Objects and Data Types, Standard Logic, Concurrent Statements		[1]
3	VHDL	Sequential Statements, Modular Designs		[1]
4	VHDL	Partitioning Design, Writing Test Benches		[1]
5	**Cryptography:** Basic building blocks.	Secret Key Cryptography, Hash Functions, Public Key Cryptography, Digital Signature Schemes, Comparison of Public Key Cryptosystems, Cryptographic Security Strength, Potential Cryptographic Applications, Fundamental Operations for Cryptographic Algorithms, Design Alternatives for Implementing Cryptographic Algorithms		[3]
6	**Mathematical Preliminaries:** Binary Finite	Multiplication, Squaring, Exponentiation,		[2][3]

	Field Arithmetic.	Division, Inversion, Irreducible Polynomials		
7	**Arithmetic Blocks:** Design of Binary Finite Field computation units.	Field Multiplication (Classical Multipliers, Karatsuba-Ofman, Squring, Reduction, Montgomery, etc.).		[2][3]
8	**Arithmetic Blocks:** Design of Binary Finite Field computation units.	Field Squaring and Field Square Root for Irreducible Trinomials, Multiplicative Inverse (Itoh-Tsujii, EEA)		[2][3]
9	**Cryptographic Blocks:** Implementation of Hash Functions: MD5.	Message Preprocessing, MD Buffer Initialization, Main Loop, Final Transformation		[3]
10	**Cryptographic Blocks:** Implementation of Hash Functions: SHA.	SHA-1, SHA-256, SHA-384, SHA-512		[3]
11	**Cryptographic Blocks:** Block Cipher hardware design	Block ciphers, Data Encryption Standard, FPGA Implementation of DES Algorithm, other DES Designs		[3]
12	**Cryptographic Blocks:** Block Cipher hardware design: AES	Rijndael Algorithm, AES, AES Implementation on FPGA, Performance		[3]
13	**Cryptographic Blocks:** Asymmetric cryptographic hardware design: Elliptic Curve Cryptography.	Hessian Form, Weierstrass Non-Singular Form, Parallel Strategies for Scalar Point Multiplication		[2][3]
14	**Cryptographic Blocks:** Asymmetric cryptographic hardware design: Elliptic Curve Cryptography.	Implementing scalar multiplication on Reconfigurable Hardware, Koblitz Curves, Half-and-Add Algorithm for Scalar Multiplication		[2][3]

Silabus dan Satuan Acara Pengajaran (SAP) EL6209

Kode Matakuliah: EL6209	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan

Nama Matakuliah	Sistem dan Teknologi Sensor untuk C4ISR
Silabus Ringkas	
Silabus Lengkap	For a domain, the systems architecture view shows how multiple systems link and interoperate, and may describe the internal construction and operations of particular systems within the architecture. For the individual system, the systems architecture view includes the physical connection, location, and identification of key nodes (including materiel item nodes), circuits, networks, warfighting platforms, etc., and specifies system and component performance parameters (e.g., mean time between failure, maintainability, availability). The systems architecture view associates physical resources and their performance attributes to the operational view and its requirements per standards defined in the technical architecture
Luaran (Outcomes)	
Matakuliah Terkait		
Kegiatan Penunjang	
Pustaka	
Panduan Penilaian	
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	The primary purpose of a systems architecture			
2	Systems architectures map systems with their associated platforms, functions, and characteristics back to the operational architecture			
3	Systems architectures identify system interfaces and define the connectivities between systems			
4	Systems architectures define system constraints and bounds of system performance behavior			
5	Systems architectures are technology-dependent, show how multiple systems within a subject area link and interoperate, and may describe the internals of particular systems			
6	Systems architectures can support multiple organizations and missions			
7	Systems architectures should clearly identify the time phase(s) covered			
8	Systems architectures are based upon and constrained by technical architectures			
9				

Silabus dan Satuan Acara Pengajaran (SAP) EL6210

Kode Matakuliah: EL6210	Bobot sks: 3	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Sistem Informasi Terintegrasi dan C4ISR			
Silabus Ringkas				
Silabus Lengkap	This course engages you in synthesis thinking which prepares you to build large information systems, those that cross platform, program, service, ... boundaries. We first discuss requirements and technology for the network which can be common to all information systems regardless of specific use. Then we discuss concepts dealing with large information system interoperability. Students can expect to go to jobs that deal with 1) requirements articulation and sponsorship, 2) applications development and 3) networking and communications infrastructure. Armed with the necessary skills, you will be able to function in jobs that deal with communications, IT applications (aka C4ISR systems) or writing the requirements for such systems.			
Luaran (Outcomes)	Upon successful completion of this course, you will be able to: • Discuss the historical parallels between the Industrial Age and the Information Age with respect to communication systems in the Navy • Define and discuss characteristics of a large information system • Describe and discuss doctrines, standards and protocols for interoperability, mobility, and modularization for information systems • Analyze the requirements of military information security systems and assess the process and tools to meet these needs			
Matakuliah Terkait	Computer Networks		Prasyarat	
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	**Definitions, Overview and Examples**	The OODA Loop European C4ISR – Review of European Systems and Investments C4ISR in action for US Air Force operations C4ISR on US Navy ships Joint Vision 2010, 2020		
2	**DoD Architecture Framework (DoDAF) Overview**	Linking Successful Warfighting, Interoperability and Well Crafted Architectures Operational, Systems, Technical Views – UML representations		
3	**Computers**	Cyber-Warfare: Threats, Defense Organizations and Defensive Strategy The Global Information Grid (GIG) and the Distributed Common Ground Station (DCGS) Evolution of Systems and Networks; Estimating Future Performance Service Oriented Architectures and		

		Interoperability		
4	**Command and Control**	Contingency Operations and their Organization – Unified Commands, the Joint Task Force Air Battle Management C2 Hierarchy Systems and Commands Sensor-to-Shooter, Time Critical Targeting (TCT) Approaches and Lessons Learned		
5	**Fundamentals, Operations, and Examples**	Fundamentals – Target Signatures and Sensor Type Receiver Operating Characteristics (ROC) Current and Future Systems Electronics Intelligence (ELINT) Signals Intelligence (SIGINT) Image Intelligence (IMINT) Passive Sensors Signals Intercept Direction Finding IR – Multi-, Hyper-, Ultra-Spectral – characteristics and effectiveness Radar: Ground Moving Target Indicator (GMTI), Synthetic Aperture Radar (SAR), I(Inverse)SAR, IF(Inter-Ferometric)SAR Clutter and Noise considerations		
6	**Tracking & Measurement Association**	Kalman Filters Multiple Hypothesis Tracking Interacting Multiple Models (IMM)		
7	**Platforms and Sensors – National**	Space Based Radar (SBR) UAVs Satellite Constellations and Persistent Coverage Overview of various ISR satellite constellations		
8	**Sensor Fusion and UAV Operations**	Systems analysis – building integrated sensor networks Performance and Examples Example Systems Visualization and M&S: Virtual Tour of an Integrated Sensor Network		
9	**Precision Targeting: Target Location**	Methods of Geolocation Errors in Target Location Implications for Battle Management		
10	**Communications**	Overview Fundamentals and definitions Networks Coding and Error Detection Joint Tactical Radio System – JTRS Jamming and Low Probability of Intercept / Detection (LPI/LPD)		

		techniques		
11	**Military Communication Channels – TADILs (Tactical Data and Information Links): Link-11, Link-16**	Challenges Interoperability Bandwidth Coordinate Alignment Coordination in Theater TADIL systems Asynchronous Transfer Mode (ATM), Time Division Multiple Access, etc.		
12	**Satellite Communications**	Overview Definitions Benefits Trade-offs Link Analysis SATCOM Systems Current and future The 2020 Transformational Communications Architecture (TCA) SATCOM and C4ISR Architecture Evolution		
13				
14				

Silabus dan Satuan Acara Pengajaran (SAP) EL6123

Kode Matakuliah: EL6123	Bobot sks: 2	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Prodi

Nama Matakuliah	Manajemen Risiko Teknologi Informasi
	Information Technology Risk Management
Silabus Ringkas	IT governance and management; IT Risk Assessment; The use of quantitative methods; The use of qualitative methods; Risk Mitigation; Disaster Recovery Plan / Business Management Continuing; Use of reference standards and IT risk; Organisational risk management
Silabus Lengkap	
Luaran (Outcomes)	After attending this course, students are expected to have an understanding: 1. IT governance and management 2. IT Risk Assessment 3. The use of quantitative methods 4. The use of qualitative methods 5. Risk Mitigation 6. Disaster Recovery Plan / Business Management Continuing 7. Use of reference standards and IT risk 8. Organisational risk management
Matakuliah Terkait	EL5126 - Perencanaan Strategis Teknologi Informasi — *Pre-requisite / Co-requisite*
	EL6213 - Tata Kelola dan Audit Teknologi Informasi — *Pre-requisite / Co-requisite*
Kegiatan Penunjang	Kuliah (2 jam/minggu)
	Responsi (2 jam/minggu)
Pustaka	ISO 31000 : 2009, Risk management - Principles and guidelines
	ISO/IEC 31010 : 2009, Risk management - Risk assessment techniques
	ITGI, CobiT V. 4.1 Framework
	ITGI, IT Risk Framework
Panduan Penilaian	Homework 30%
	Project 70%
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	IT governance and management			
2	IT Risk Assessment			
3	IT Risk Assessment			
4	The use of quantitative methods			
5	The use of qualitative methods			
6	Risk Mitigation			
7	Risk Mitigation			
8	Disaster Recovery Plan / Business Management Continuing			
9	Use of reference standards and IT risk			
10	Use of reference standards and IT risk			
11	Use of reference standards and IT risk			
12	Organisational risk management			
13	Organisational risk management			
14	Organisational risk management			
15	Organisational risk management			

16	Final Assigment			

Silabus dan Satuan Acara Pengajaran (SAP) EL5223

Kode Matakuliah: EL5223	Bobot sks: 2	Semester: Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Prodi

Nama Matakuliah	Manajemen Perubahan
	Change Management
Silabus Ringkas	A pervasive challenge for all organizations and their leaders/managers is how to initiate, lead, manage, implement, and sustain major change. If anything, contemporary business environments make the ongoing need for organizational change even more critical than earlier. Organizational Change efforts are the lifeblood of management consulting and engage top management attention as well. Thus, this module is especially useful for students who plan careers in general management, whether in line or staff positions, even though students interested in entrepreneurship, strategy, and human resources will also benefit from the course content.
Silabus Lengkap	
Luaran (Outcomes)	1. Providing the students with the knowledge and exercises about Organizational Change 2. Allowing students use the Change Management Techniques to help executing Corporate Transformation programs 3. Introducing the students with the Human relationship skills which are utmost important to lead and manage Change
Matakuliah Terkait		
Kegiatan Penunjang	Kuliah (3 jam/minggu) Responsi (3 jam/minggu)
Pustaka	1. Ian Palmer, et. Al. : Managing Organizational Change – A Multiple Perspectives Approach", McGraw Hill International Edition, 2006.
	2. Esther Cameron & Mike Green : "Making Sense of Change Management – A Complete Guide to the Models, Tools & Techniques of Organizational Change.
	3. Relevant Harvard Business Review Series, HBS Case Studies, and Ivey Business School Case Study.
	4. Jeffrey M. Hyatt :"Prosci Change Management".
	5. John P. Kotter: "Leading Change", HBSP.
	6. Rosabeth Moss Kanter, et. Al.: The Challenge of Organizational Change – How Companies Experience It and Leaders Guide It", Free Press, 1992.
Panduan Penilaian	Homework 10% Quiz 10% Exam 30% Project 40%
Catatan Tambahan	

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction: Stories of Change Image of Managing Change			
2	Why Organizations Change What Changes in Organizations			
3	Lab for Change Resistance to Change			
4	Case 1: Cisco Systems, Inc.: Implementing ERP Case 2: Boeing's e-Enabled Advantage			
5	Case 3: Apple Inc., 2008 Case 4: Maple Leaf Foods (A) – Leading Six Sigma Change (Ivey Business School Case)			
6	Case 5: Change at Whirpool Corporation (B) & (C)			
7	Mid-term Test (Ujian Tengah Semester = UTS)			
8	Implementing Change			
9	Linking Vision and Strategy			

	Strategies for Communicating Change			
10	Case 6: Otis Elevator: Accelerating Business Transformation with IT			
11	Case 7: GE's Talent Machine – The Making of a CEO			
12	Case 8: JetBlue – Is the Sky the Limits? (INSEAD Case)			
13	Case 9: Meg Whitman at eBay Inc (A) Case 10: Google Inc.			
14	Final Test (Ujian Akhir Semester = UAS)			

Silabus dan Satuan Acara Pengajaran (SAP) EL5070

Kode Matakuliah: **EL5070**	Bobot sks: **2**	Semester: **Ganjil dan Genap**	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Operasi dan Pemeliharaan Sistem Tegangan Listrik			
Silabus Ringkas	Pada mata kuliah ini akan dipelajari materi-materi mengenai prinsip-prinsip pemeliharaan mekanik serta operasi-operasi dari perangkat-perangkat dan mesin-mesin yang digunakan dalam transmisi sistem tegangan listrik.			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Synchronous Machines			
2	Transformers and reactors in Power Systems			
3	Wheeling, Tariffs			
4	Power system steady state conditions			
5	Power System stability			
6	Voltage stability			
7	Demand Side Management			
8	Power balance and Frequency control			
9	Over-voltages and fault currents			
10	Interconnected system operation			
11	Disturbances and collapses in power systems			
12	Switching operations			
13	Safety			
14				
15				

Silabus dan Satuan Acara Pengajaran (SAP) EL5078

Kode Matakuliah: EL5078	Bobot sks: 2	Semester: Ganjil dan Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Pembangkit Non Konvensional dan Terbarukan			
Silabus Ringkas	Mata kuliah ini mencakup materi mengenai pembangkitan energi-energi yang tidak konvensional seperti tenaga matahari, biofuel, hydroelectric, tenaga pasang surut dan gelombang, dan energi-energi alternatif lainnya.			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	The concept of entropy and reversibility			
2	The Rankine cycle			
3	Superheating			
4	Fossil-fuel system generators			
5	Fuels and combustion			
6	Turbo-machinery basics			
7	Feedwater systems			
8	Cooling towers			
9	Gas cycles			
10	Principles of nuclear energy			
11	Non conventional power generating plants			
12	The concept of entropy and reversibility			
13	The Rankine cycle			
14	Superheating			
15	Fossil-fuel system generators			

Silabus dan Satuan Acara Pengajaran (SAP) EL5172

Kode Matakuliah: EL5172	Bobot sks: 2	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Operasi dan Kendali Sistem Tenaga			
Silabus Ringkas	This course presents an introduction to power system operation and control. This course also deals with day to day operation of the power system and the control actions to be implemented on the system in order to meet the minute-to-minute variation of system load demand. Topics include: Energy resources and electric power generation; load frequency control, reactive power and voltage control, unit commitment and economic load dispatch, introduction to power system stability, operating strategies and control; modern power systems and power converters; DC/AC and AC/DC conversion; and introduction to DC transmission.			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Introduction			
2	Real Power - Frequency Problem (I)			
3	Real Power - Frequency Problem (II)			
4	Real Power - Frequency Problem (III)			
5	Reactive Power – Voltage Control (I)			
6	Reactive Power – Voltage Control (II)			
7	Reactive Power – Voltage Control (III)			
8	Economic Load Dispatch (I)			
9	Economic Load Dispatch (II)			
10	Economic Load Dispatch (III)			
11	Computer control of power systems (I)			
12	Computer control of power systems (II)			
13	Computer control of power systems (III)			
14	Computer control of power systems (IV)			
15				

Silabus dan Satuan Acara Pengajaran (SAP) EL5173

Kode Matakuliah: **EL5173**	Bobot sks: **2**	Semester: **Ganjil**	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Wajib Jalur
Nama Matakuliah	Komputasi dalam Teknik Tenaga Elektrik			
Silabus Ringkas	This course analyzed the basic techniques for the efficient numerical solution of problems in power system. Topics spanned root finding, interpolation, approximation of functions, integration, differential equations and direct and iterative methods in linear algebra			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	System of Linear Equation I			
2	System of Linear Equation II			
3	Interpolation			
4	Curve Fitting			
5	Nonlinear Equation I			
6	Nonlinear Equation II			
7	Numerical Differentiation			
8	Numerical Integration			
9	Ordinary Differential Equation			
10	Optimization			
11	Matrices			
12	Eigenvalues			
13	Partial Differential Equation I			
14	Partial Differential Equation II			
15				

Silabus dan Satuan Acara Pengajaran (SAP) EL6071

Kode Matakuliah: EL6071	Bobot sks: 2	Semester: Ganjil	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Pengukuran dan Instrumentasi pada Sistem Tenaga			
Silabus Ringkas	This course covers the basic measurement techniques, instruments, and methods used in everyday practice. It covers in detail both analogue and digital instruments, measurements errors and uncertainty, instrument transformers, bridges, amplifiers, oscilloscopes, data acquisition, sensors, instrument controls and measurement systems. Students will learn how to apply the most appropriate measurement method and instrument for a particular application, and how to assemble the measurement system from physical quantity to the digital data in a computer.			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Measurement of large currents and voltages			
2	current and voltage transformers			
3	design equations and operational characteristics			
4	error compensation schemes			
5	Protective CTs and PTs			
6	overload and transient performance			
7	standard specification of instrument transformers			
8	DC current transformers			
9	measurement of power and energy			
10	torque equation of induction type energy meter, parasitic torques and their minimization,			
11	IS specifications, analog and digital KVAr			
12	Tele-metering, remote terminal units			
13	data acquisition systems			
14	tri-vector meters			
15	event and disturbance recorders			

Silabus dan Satuan Acara Pengajaran (SAP) EL6072

Kode Matakuliah: EL6072	Bobot sks: 2	Semester: Ganjil dan Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Sistem Proteksi Tegangan Lebih Transien			
Silabus Ringkas	This course aims to review the over voltages (or) surges due to the phenomena of switching operations and lighting discharge. Also to study propagation, reflection and refraction of these surges on the equipments their impact on the power system grid.			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Is Overvoltage Protection worthwhile?			
2	Electromagnetic compability			
3	What are overvoltages?			
4	How do overvoltages occur?			
5	Prevention is better than cure			
6	How do we achieve Overvoltage Protection?			
7	Classification and protective zones			
8	Components for Overvoltage Protection			
9	Network forms			
10	Office building with lightning protection			
11	Industrial building with lightning protection			
12	General installation advice			
13	Summary of standards and regulations			
14	Overvoltage Protection concept			
15	Is Overvoltage Protection worthwhile?			

Silabus dan Satuan Acara Pengajaran (SAP) EL6073

Kode Matakuliah: EL6073	*Bobot sks:* 2	*Semester:* Ganjil dan Genap	*Unit Penanggung Jawab:* Program Studi Magister TE	*Sifat:* Pilihan

Nama Matakuliah	Fenomena Listrik Atmosfer	
Silabus Ringkas	To provide the student with an overview and understanding of the electrical nature of the earth's atmosphere. The course material will introduce the two fundamental areas of fair weather and disturbed weather electricity focusing on Ohm's law and the various properties of the lower atmosphere that produce Ohm's law behavior for the fair weather portion. Disturbed weather electricity has two basic, but related topics: thunderstorm electrification and lightning. The student will learn the components making up the lightning flash and their characteristics as well as the physics used as a basis for making measurements with respect to lightning and electrified storms. In the realm of thunderstorm electrification, the history of the development of charge separation theories will be presented along with results from the application of the most current theories in the context of state-of-the-art thunderstorm electrical models, including the parameterization of the lightning process and the production of chemical species by lightning.	
Silabus Lengkap		
Luaran (Outcomes)	At the completion of the course the student should be able to: read and have a basic understanding of text material and the refereed literature in the area of atmospheric electricity, explain the global electric circuit including the fair weather and thunderstorm branches and the role each branch plays in maintaining the air-earth current flow, detail the processes that make up various types of lightning discharges, and describe various theories of charge separation. The student should also be able to solve problems in electrostatics related to lightning and storm-produced charge distributions.	
Matakuliah Terkait		
Kegiatan Penunjang		
Pustaka		
Panduan Penilaian		
Catatan Tambahan		

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Course overview and introduction			
2	Review vectors, review Electricity & Magnetism			
3	Summary of Maxwell's Equations & examples			
4	Ions, mobility, conductivity, and diffusion			
5	Recombination, ion eqns, Gish eqn, charge dens., potential			
6	Air-Earth current, charge separation, variability			
7	Ionization influence on E-field, columnar resistance			
8	Measurement of ions, conductivity, and mobility			
9	Baseline measurements at Moana Loa			
10	Electrode effect, meteor. influences, conductivity profiles			
11	Conductivity profile (cont.), equalization layer			
12	Theoretical expressions for ion and field profiles			
13	Lightning characteristics			
14	Electrostatics			

Silabus dan Satuan Acara Pengajaran (SAP) EL6074

Kode Matakuliah: EL6074	Bobot sks: 2	Semester: Ganjil dan Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Komputasi pada Sistem Tenaga			
Silabus Ringkas	This course analyzed the basic techniques for the efficient numerical solution of problems in power system. Topics spanned root finding, interpolation, approximation of functions, integration, differential equations and direct and iterative methods in linear algebra			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	System of Linear Equation I			
2	System of Linear Equation II			
3	Interpolation			
4	Curve Fitting			
5	Nonlinear Equation I			
6	Nonlinear Equation II			
7	Numerical Differentiation			
8	Numerical Integration			
9	Ordinary Differential Equation			
10	Optimization			
11	Matrices			
12	Eigenvalues			
13	Partial Differential Equation I			
14	Partial Differential Equation II			
15				

Silabus dan Satuan Acara Pengajaran (SAP) EL6076

Kode Matakuliah: EL6076	Bobot sks: 2	Semester: Ganjil dan Genap	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Perencanaan Sistem Tenaga Lanjut			
Silabus Ringkas	A study of generation planning, bulk power supply systems, production costing analysis and load forecasting. Dispersed generation. Electric power system reliability and stability.			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Restructured power system (I)			
2	Restructured power system (II)			
3	Load forecasting (I)			
4	Load forecasting (II)			
5	Reliability and availability (I)			
6	Reliability and availability (II)			
7	Generation planning (I)			
8	Generation planning (II)			
9	Bulk power transmission planning(I)			
10	Bulk power transmission planning(II)			
11	Transient and dynamic stability (I)			
12	Transient and dynamic stability (II)			
13	Production costing analysis (I)			
14	Production costing analysis (II)			

Silabus dan Satuan Acara Pengajaran (SAP) EL6077

Kode Matakuliah: **EL6077**	Bobot sks: **2**	Semester: **Ganjil dan Genap**	Unit Penanggung Jawab: Program Studi Magister TE	Sifat: Pilihan
Nama Matakuliah	Kendali dan Kestabilan Sistem Tenaga			
Silabus Ringkas	Stability concepts in power systems. Synchronous machine modeling. Load-frequency control modeling of synchronous machines. Excitation system types and their dynamic models. Single machine dynamic models. Multimachine dynamic modles. Small-signal models and stability of synchronous machines. Computer based simulations of the above developed models. Transient stability and stability margin enhancement.			
Silabus Lengkap				
Luaran (Outcomes)				
Matakuliah Terkait				
Kegiatan Penunjang				
Pustaka				
Panduan Penilaian				
Catatan Tambahan				

Mg#	Topik	Sub Topik	Capaian Belajar Mahasiswa	Sumber Materi
1	Stability concepts in power systems.			
2	Synchronous machine modeling.			
3	Load-frequency control modeling of synchronous machines.			
4	Excitation system types and their dynamic models.			
5	Single machine dynamic models.			
6	Multimachine dynamic modles.			
7	Small-signal models			
8	stability of synchronous machines.			
9	Computer based simulations of the above developed models.			
10	Transient stability			
11	Stability margin enhancement.			
12				
13				
14				
15				