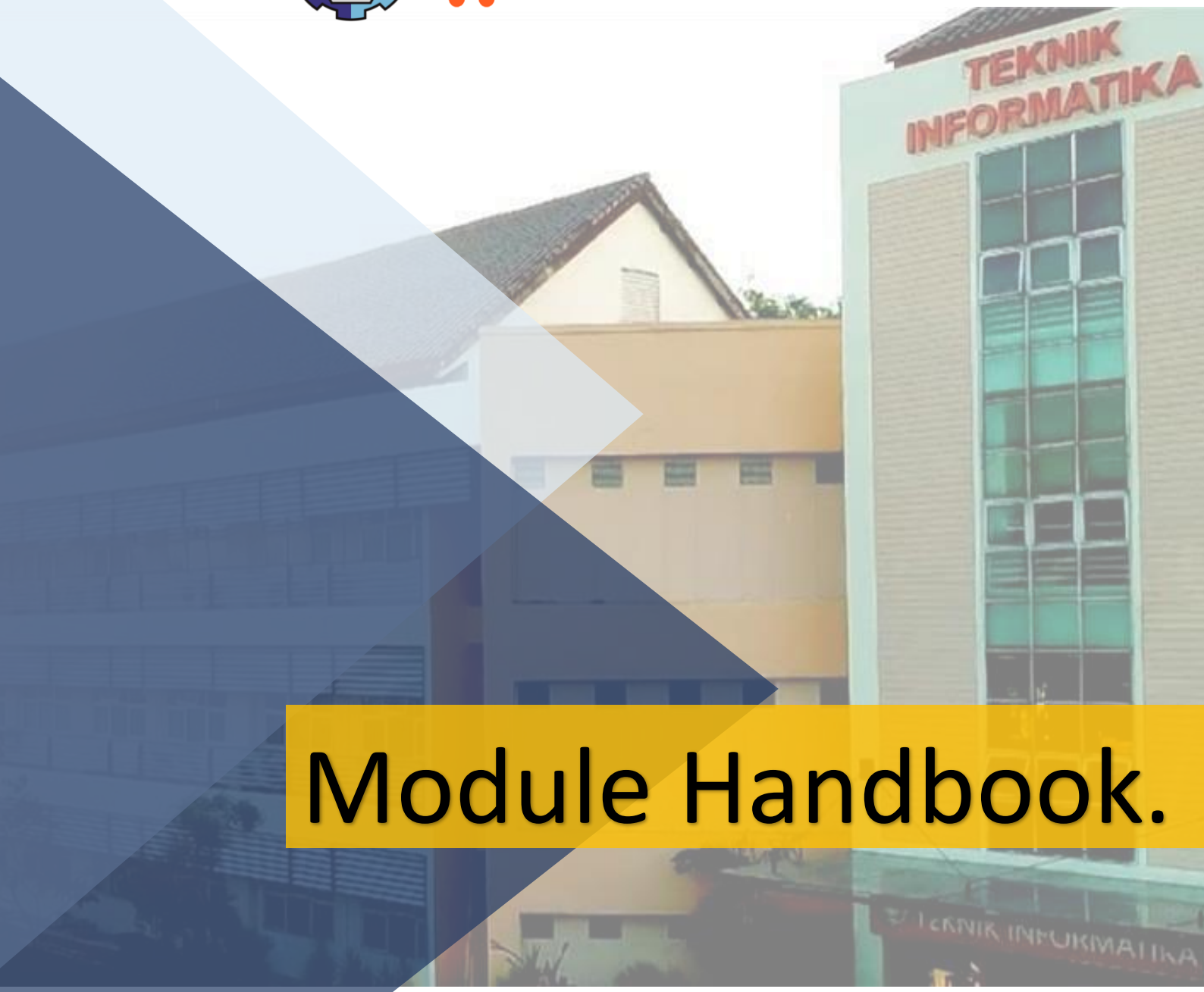

Module Handbook.

BARCHELOR OF INFORMATICS PROGRAM (BIP)
DEPARTMENT OF INFORMATICS
FACULTY OF INTELLIGENCE ELECTRICAL AND INFORMATICS TECHNOLOGY
INSTITUT TEKNOLOGI SEPULUH NOPEMBER

DETERMINATION OF GRAFUATED LEARNING OUTCOMES
BACHELOR OF INFORMATICS PROGRAM (BIP)
INSTITUT TEKNOLOGI SEPULUH NOPEMBER

The Program Learning Outcomes (PLO) of the Bachelor of Informatics (BIP) Program:

PLO-1	*Able to show attitudes and characters that reflect: piety to God Almighty, noble character, sensitivity, and concern about social and environmental issues, respecting cultural differences and pluralism, upholding law enforcement, prioritizing the interests of the nation and the broader community through innovation, creativity, and inovation, excellence, strong leadership, synergy with other potentials to achieve maksimum results.*
PLO-2	*Able to study and utilize science and technology to apply it i*nformatics fields consist of computer networks, cyber security, information management, modeling and simulation*, and able to make appropriate decisions from the results of their work and group work through logical, critical, systematic, and innovative thinking*
PLO-3	*Able to manage their learning and develop themselves as lifelong learners to compete at national and international levels to make a real contribution to solving problems by paying attention to the principle of sustainability.*
PLO-4	*Mastering the concepts and principles of intelligent systems and computational science, and able to design and build applications by applying those principles to produce smart application products in various fields*
PLO-5	*Mastering the concepts and principles of architecture, systems and the basics of computer networks based on logic systems, and able to apply those principles to design, implement and manage network systems that have high performance, are safe, and efficient*
PLO-6	*Mastering the theoretical concepts and principles of network-based computing and the latest technologies associated with it and able to apply those concepts, to analyze and design computational problem solving algorithms in various fields*
PLO-7	*Mastering the principles of making an algorithm and various programming language concepts, and able to design and analyze algorithms to solve problems effectively and efficiently based on strong programming principles, and apply it to software development based on software engineering concepts and principles.*
PLO-8	*Mastering the principles of graphics and interaction, as well as able to develop and evaluate the user interfaces of applications and/or games according to those principles*

PLO-9	*Mastering problem-solving principles and techniques using: calculus, matrices, statistics, approximation, liner optimization, modeling and simulation, and able to solve computational problems and mathematical modeling through exact, stochastic, probabilistic and numerical approaches effectively and efficiently*
PLO-10	*Mastering the concepts and principles of capturing, processing, and storing information in various forms and able to collect, digitize, and process data into new useful information using effective and efficient data storage and modelling.*

COURSE LIST OF BACHELOR PROGRAM

Course Code	Course Name	Credit
SEMESTER 1		
SM234101	*Calculus 1*	3
EF234101	*Fundamental Programming*	4
EF234102	*Digital System*	3
EF234103	*Linear Algebra*	3
EF234104	*Database System*	4
	Total Credits	17
SEMESTER 2		
EF234201	*Data Structure*	4
EF234202	*Operating System*	4
EF234203	*Computer Organization*	3
EF234204	*Numerical Computation*	3
SM234201	*Calculus 2*	3
EW234201	*Introduction to Intelligent Electrical and Informatics Technology*	2
	Total Credits	19
SEMESTER 3		
EF234301	*Web Programming*	3
EF234302	*Object Oriented Programming*	3
EF234303	*Computer Network*	4
EF234304	*Graph Theory*	3
EF234305	*Discrete Mathematics*	3
EK234201	*Artificial Intelligence Concepts*	3
EF234307	*Software Development Principles*	2
	Total Credits	21
SEMESTER 4		
EF234401	*Network Programming*	3
EF234402	*Probabilistic and Statistic*	3
EF234403	*Automata*	2
EF234404	*Database Management*	3
EF234405	*Algorithm Design and Analysis*	3
EF234406	*Machine Learning*	3
ER234301	*Software Design*	3
	Total Credits	20
SEMESTER 5		
EF234501	*Framework-based Programming*	3
EF234502	*Information Security*	3
EF234503	*Modeling and Simulation*	3
EF234504	*Computer Graphics*	3

EF234505	*Knowledge based Engineering*	3
	Elective 1	3
	Elective 2	3
	Total Credits	21
SEMESTER 6		
UG234914	*English*	2
UG234915	*Technopreneurship*	2
UG23490X	*Religion*	2
UG234913	*Civics*	2
EF234601	*Mobile Programming*	3
EF234602	Human and Computer Interaction	3
EF234622	Capstone Project	3
	Capstone Project	
EF234603	*Practical Work*	4
	Total Credits	21
SEMESTER 7		
UG234912	*Indonesian*	2
UG234911	*Pancasila*	2
UG234916	*Applied Technology and Digital Transformation*	3
EF234701	*Professional Ethics*	2
EF234702	*Undergraduate Pre-Thesis*	2
	Elective3	3
	Elective 4	3
	Enrichment Course	3
	Total Credits	20
SEMESTER 8		
EF234801	*Final Project*	5
	Total SKS	5

LIST OF ELECTIVE COURSES

No	Course Code	Course Name	Credit
1	EF234506	Inter-Network Technology	3
2	EF234507	Wireless Network	3
3	EF234508	Distributed System	3
4	EF234509	Competitive Programming	3
5	EF234510	Operations Research	3
6	EF234511	Game Development Techniques	3
7	EF234513	Enterprise Systems	3
8	EF234514	Information Technology Governance	3
9	ER234504	Software Project Management	3
10	ER234201	Requirements Engineering	3
11	EF234517	Image Processing and Computer Vision	3
12	EF234518	Data Mining	3
13	EF234604	Mobile Computing	3
14	EF234605	Pervasive Computing and Sensor Networks	3
15	EF234606	Network Security	3
16	EF234607	Application Security	3
17	EF234608	Interface Based Programming	3
18	EF234609	Dynamic Systems Simulation	3
19	EF234610	Agent Based Simulation	3
20	EF234611	Forecasting Techniques	3
21	EF234612	Computer Animation and 3D Modeling	3
22	EF234613	Educational and Simulation Games	3
23	EF234614	User Experience Design	3
24	EF234615	System Audit	3
25	EF234616	Distributed Database	3
26	EF234617	Geographic Information Systems	3
27	ER234503	Software Quality	3
28	ER234402	Software Construction	3
29	EK234501	Text Mining	3
30	EF234619	Deep Learning	3
31	EF234618	Game Engine	3
32	EF234703	IoT Technology	3
33	EF234704	Cloud Computing	3
34	EF234705	Digital Forensics	3
35	EF234706	Signal Processing Programming	3
36	EF234707	Applied Science Data Programming	3
37	EF234708	Multivariate Data Analysis	3
38	EF234709	Object Oriented Simulation	3

39	EF234710	Intelligence Game	3
40	EF234711	Extended Reality	3
41	EF234712	Big Data	3
42	EF234713	Quantum Computing	3
43	ER234403	Software Architecture	3
44	ER234505	Software Evolution	3
45	EK234601	Robotics	3
46	EF234714	Special Topics in Algorithms and Programming	3
47	EF234715	Special Topics in Computer Architecture and Networks	3
48	EF234716	Special Topics in Graphics, Interaction and Games	3
49	EF234717	Special Topics in Network-Based Computing	3
50	EF234718	Special Topics in Intelligent Computing and Vision	3
51	EF234719	Special Topics in Intelligent Information Management	3
52	EF234720	Special Topics in Modelling and Applied Computing	3
53	EF234721	Special Topics in Software Engineering	3
54	EF234722	Internship	6

Semester 1

Calculus 1

Course (*Mata Kuliah*)	**Calculus 1 (*Kalkulus 1*)**
Code (*Kode Mata Kuliah*)	SM224101
Semester	1
Lecturer (*Dosen Pengampu*)	Dr. Tahiyatul Asfihani, S.Si, M.Si Prof. Dr. Drs. Chairul Imron, M.Ikom M. Syifa'ul Mufid, S.Si, M.Si, Ph.D Dian Winda S., S.Si, M.Si Amirul Hakam, S.Si, M.Si
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory/elective] International undergraduate program, [compulsory/elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	In this course, students will learn the following subjects: 1. Basic concept of real number system: definition of real number system, decimal form of real number, coordinate system, nature of sequence, definition of absolute value, graph of linear equations. 2. The basic concept of complex numbers: addition, multiplication, quotient, polar form of complex numbers and their algebraic operations and the drawing of equations in complex number systems. 3. The basic concept of matrix algebra, determinant properties, elementary line operations, systems of linear equations and the problem of eigenvalues or eigenvectors. 4. The concepts of function, limit: domain, range, linear, quadratic and trigonometric or transcendent

	function, function graph, limit function and continuity. 5. Differential / derivative: definition of derivatives, referenced rules (for polynomial, trigonometric, tramsendent functions), chain rules and implicit derivatives of functions. 6. Derivative Applications: corresponding rates, increment interval, slope, graph sketch having asymptotes and peaks, extrema values and application of optimization problems. 7. Indefinite integral: Derivative and anti-derivative, Fundamental Theorems of Calculus. *Dalam Mata Kuliah ini mahasiswa akan mempelajari pokok bahasan pokok bahasan sebagai berikut:* *1. Konsep dasar sistem bilangan real: pengertian sistem bilangan real, bentuk desimal bilangan real, sistem koordinat , sifat urutan, pengertian nilai mutlak, garis – grafik persamaan linear.* *2. Konsep dasar bilangan kompleks: penjumlahan, perkalian, hasil bagi, bentuk polar bilangan kompeks beserta operasi aljabarnya dan penarikan akar persamaan dalam sistem bilangan kompleks.* *3. Konsep dasar aljabar matrik, sifat-sifat determinan, operasi baris elementer, sistem persamaan linier dan masalah nilai eigen atau vector eigen.* *4. Konsep-konsep fungsi, limit: domain, range, fungsi linier, kuadratik dan trigonometri atau transcendent, grafik fungsi, limit fungsi dan kontinuitas.* *5. Diferensial/turunan: definisi turunan, aturan-aturan diferensisasi (untuk fungsi polynomial, trigonometri, tramsendent), aturan rantai dan turunan fungsi implisit.* *6. Aplikasi Turunan: laju-laju berkaitan, interval naik-turun, kecekungan, sketsa grafik yang mempunyai asimtot dan puncak, nilai ekstrema dan aplikasi masalah optimasi.* *7. Integral tak-tentu: turunan dan anti turunan , Theorema Fundamental Kalkulus.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to apply equalities or inequalities as well as graphs of linear equation functions. 2. Students are able to apply complex variable forms in polar form and get the roots of the equation. 3. Students are able to apply matrix concepts to solve a linear equation system and determine the eigen value. 4. Students are able to determine the continuity of functions and their derivatives. 5. Students are able to apply integrals through the fundamental theorem of calculus. 1. *Mahasiswa mampu menerapkan persamaan atau pertidaksamaan serta grafik fungsi persamaan linear.* 2. *Mahasiswa mampu mengaplikasikan bentuk peubah kompleks dalam bentuk polar serta mencari akar-akar persamaannya.* 3. *Mahasiswa mampu menerapkan konsep matriks untuk menyelesaikan sistem persamaan linier dan menentukan nilai eigen.* 4. *Mahasiswa mampu menentukan kekontinuan fungsi dan turunanannya.* 5. *Mahasiswa mampu menerapkan integral melalui teorema fundamental kalkulus.*
Content (*Materi Pembelajaran*)	• Real number system, absolute value, graph equations, lines, linear equations • Complex numbers and De Moivre's Theorem • Matrices and their operations, elementary row operations and inverse matrices • systems of linear equations, determinants, minor, cofactors and Cramer's rule. • Eigenvalues and eigenvectors. • Graph of functions and its operation • limit notation, calculating limits, limit at infinity. • Continuity • Related rates • Interval of the function, function concavity, relative extreme, first and second derivative test

	• Application of maximum and minimum problems • Integral • *Sistem bilangan real, nilai mutlak, grafik persamaan dan garis, persamaan linear* • *Bilangan kompleks dan Teorema De Moivre* • *Matriks dan operasinya, operasi baris elementer dan matriks invers* • *Sistem persamaan linear, determinan, minor, kofaktor dan aturan Cramer.* • *Nilai eigen dan vektor eigen.* • *Grafik fungsi dan operasinya.* • *notasi limit, penghitungan limits, limit di tak-hingga.* • *Kekontinuan fungsi* • *Garis singgung dan laju perubahan, fungsi turunan, diferensiasi.* • *Laju-laju yang berkaitan* • *Selang naik dan selang turun, kecekungan fungsi, ekstrim relatif, uji turunan pertama dan kedua* • *Aplikasi masalah maksimum dan minimum* • *Integral*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Tim Dosen Jurusan Matematika ITS, Diktat Matematika 1 , Edisi ke-5 Jurusan Matematika ITS, 2020 2. Anton, H. dkk, Calculus, 10-th edition, John Wiley & Sons, New York, 2012 Supporting: 1. Kreyzig, E, *Advanced Engineering Mathematics*, 10-th edition, John Wiley & Sons, Singapore, 2011

	2. Purcell, J, E, Rigdon, S., E., *Calculus,* 9-th edition, Prentice-Hall, New Jersey, 2006 3. James Stewart , *Calculus*, ed.7, Brooks/cole-Cengage Learning, Canada,2012

Fundamental Programming

Course (*Mata Kuliah*)	**Fundamental Programming (*Dasar Pemrograman*)**
Code (*Kode Mata Kuliah*)	EF234101
Semester	1
Lecturer (*Dosen Pengampu*)	Fundamental Programming Lecturer Team
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory/elective] International undergraduate program, [compulsory/elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week 4. Lab Works (*Praktikum*): 1x50'/week
Credit points (*SKS*)	4
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The Programming Fundamentals course is designed to learn a disciplined approach to problem solving, applying widely accepted software engineering methods to design program solutions as compact, readable, and reusable modules. *Perkuliahan Dasar Pemrograman ini dirancang untuk mempelajari pendekatan disiplin terhadap pemecahan masalah, menerapkan metode rekayasa perangkat lunak yang diterima secara luas untuk merancang solusi program sebagai modul yang kompak, mudah dibaca, dan dapat digunakan kembali.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand soft development methodology (analysis, design, coding, testing, documentation) and apply this methodology to simple problems. 2. Students are able to translate designs into algorithms correctly and structured.

	3. Students are able to design modular structured programs with a top-down approach using functions in the C language. 4. Students are able to carry out testing and debugging processes. 5. Students are able to think comprehensively in designing and implementing programs in C language. 6. Students are able to communicate and work together in a team through the program documentation mechanism. 1. *Mahasiswa mampu memahami metodologi pengembangan lunak (analisis, design, coding, testing, dokumentasi) dan menerapkan metodologi tersebut pada persoalan-persoalan sederhana.* 2. *Mahasiswa Mampu menterjemahkan design menjadi algoritma dengan benar dan terstruktur.* 3. *Mahasiswa Mampu merancang program terstruktur secara modular dengan pendekatan top-down menggunakan fungsi-fungsi dalam bahasa C.* 4. *Mahasiswa mampu melakukan proses pengujian dan debugging.* 5. *Mahasiswa mampu berpikir komprehensif dalam merancang dan mengimplementasi program dalam bahasa C.* 6. *Mahasiswa mampu berkomunikasi dan bekerja sama dalam sebuah tim melalui mekanisme dokumentasi program*.
Content (*Materi Pembelajaran*)	In this course the following topics are studied: general overview of computers and programming, general overview of the C language, top-down design using functions, if and switch selection command structures, loop and loop commands, pointers and modular programming, arrays of pointers, strings , recursive, text and binary file pointers. *Dalam matakuliah ini dipelajari pokok-pokok bahasan: gambaran umum tentang komputer dan*

	pemrograman, gambaran umum tentang bahasa C, perancangan top-down menggunakan fungsi, struktur perintah seleksi if dan switch, perintah perulangan dan loop, pointers dan pemrograman modular, array pointers, strings, rekursif, pointer file teks dan biner.
Study and examination requirements and forms of examination	1. Exercises 2. Lab Works 3. Midtest 4. Final exam *1. Latihan soal* *2. Praktikum* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: - Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, 8th edition, Pearson Education Limited, 2016. Supporting: - P. J. Deitel, H. M. Deitel, C How to Program, 6th edition, Pearson Prentice Hall, 2010.

Digital System

Course (*Mata Kuliah*)	**Digital System (*Sistem Digital*)**
Code (*Kode Mata Kuliah*)	EF234102
Semester	1
Lecturer (*Dosen Pengampu*)	Digital System Lecturer Team
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory/elective] International undergraduate program, [compulsory/elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This course explains number systems, describes Boolean function of digital systems and its simplification using some methods, and explains the function and characteristic of digital system components. It also analyses and design digital systems, both combinational and sequential system. *Mata kuliah ini menjelaskan tentang sistem bilangan, menjelaskan fungsi Boolean sistem digital dan penyederhanaannya dengan beberapa metode, serta menjelaskan fungsi dan karakteristik komponen sistem digital. Ia juga menganalisis dan merancang sistem digital, baik sistem kombinasional maupun sekuensial.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students understand the basics of number systems, simplification of Boolean functions, and logic gates. 2. Students are able to understand and use existing combinational and sequential circuits to solve problems. 3. Students are able to design combinational circuits and sequential circuits to solve problems efficiently.

	1. Mahasiswa memahami dasar-dasar sistem bilangan, penyederhanaan fungsi Boolean, dan gerbang logika. *2. Mahasiswa mampu memahami dan menggunakan rangkaian kombinasional dan sekuensial yang sudah ada untuk menyelesaikan permasalahan.* *3. Mahasiswa mampu mendesain rangkaian kombinasional dan rangkaian sekuensial untuk memecahkan permasalahan secara efisien.*
Content (*Materi Pembelajaran*)	- Types of number systems and their coding - Boolean algebra, Truth tables and SOP and POS statements - Logic function - Simple circuit - Registers and counters - Memory type - Macam sistem bilangan dan pengkodeannya - aljabar Boolean, Tabel kebenaran dan pernyataan SOP dan POS - Fungsi logika - Rangkaian sederhana - Register dan counter - Jenis memori
Study and examination requirements and forms of examination	1. Post test 2. Midtest 3. Final exam *1. Ujian akhir* *2. Evaluasi Tengah Semester* *3. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: - Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, 8th edition, Pearson Education Limited, 2016. Supporting: - P. J. Deitel, H. M. Deitel, C How to Program, 6th edition, Pearson Prentice Hall, 2010.

Linear Algebra

Course (*Mata Kuliah*)	**Linear Algebra (*Aljabar Linier*)**
Code (*Kode Mata Kuliah*)	EF234103
Semester	1
Lecturer (*Dosen Pengampu*)	Linear Algebra Lecturer Team
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory/elective] International undergraduate program, [compulsory/elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The Linear Algebra course is designed so that students can solve systems of linear equations using various methods, students are able to solve matrix, vector space, basis and eigen operation problems. *Mata kuliah Aljabar Linier dirancang agar mahasiswa dapat menyelesaikan masalah sistem persamaan linier dengan berbagai metode, mahasiswa mampu menyelesaikan masalah operasi matriks, ruang vektor, basis dan eigen.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and solve systems of linear equations using matrix computing. 2. Students are able to solve matrix operation problems. 3. Students are able to solve vector space problems. 4. Students are able to find a base. 5. Students are able to solve eigen problems. 1. *Mahasiswa mampu memahami dan menyelesaikan masalah sistem persamaan linier dengan menggunakan komputasi matriks.*

	2. *Mahasiswa mampu menyelesaikan masalah operasi matriks.* 3. *Mahasiswa mampu menyelesaikan masalah ruang vektor.* 4. *Mahasiswa mampu mencari basis.* 5. *Mahasiswa mampu menyelesaikan masalah eigen.*
Content (*Materi Pembelajaran*)	1. Introduction to systems of linear equations (SPL) problems 2. SPL can be solved using Gauss elimination, Gauss Jordan, Cramer. 3. Search for determinants using elementary row operations and cofactors. 4. Inverse search using elementary row operations and cofactors. 5. In vector space problems, we will look for plane equations, parametric equations, symmetric equations, dot products, cross products and linear transformations. 6. Basis material includes spanning, linear independence, homogeneous linear equations, old basis and new basis, general solution, row space basis, column space basis, orthonormal basis, Schmidt gram. 7. Eigen problems, which will be searched for are eigenvalues and eigenvectors, diagonalization, orthogonal diagonalization 1. *Pengenalan masalah sistem persamaan linier (SPL)* 2. *SPL dapat diselesaikan dengan menggunakan eliminasi gauss, Gauss Jordan, Cramer.* 3. *Pencarian determinan dengan menggunakan Operasi baris elementer dan kofaktor.* 4. *Pencarian invers dengan menggunakan Operasi baris elementer dan kofaktor.* 5. *Pada masalah ruang vektor, akan dicari persamaan bidang, persamaan parametrik, persamaan simetrik, dot product, cross product dan transformasi linier.* 6. *Materi basis meliputi Merentang, bebas linier, persamaan linier homogen, basis lama dan basis*

	baru, general solusi, basis ruang baris, basis ruang kolom, basis orthonormal, gram schmidt. 7. *Masalah eigen, yang akan dicari adalah eigenvalue dan eigenvektor, diagonalization, ortogonal diagonalization*
Study and examination requirements and forms of examination	1. Assignments 2. Quiz 3. Midtest 4. Final exam *1. Tugas* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: - Elementary Linear Algebra ; Howard Anton, Drexel University, John Wiley & Sons, Inc; ninth edition, 2005 - Elementary Linear Algebra - applications version; Howard Anton, Chris Rorres; John Wiley & Sons, Inc; ninth edition, 2005

Database System

Course (*Mata Kuliah*)	**Database System (Sistem Basis Data)**
Code (*Kode Mata Kuliah*)	EF234104
Semester	1
Lecturer (*Dosen Pengampu*)	Database System Lecturer Team
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory/elective] International undergraduate program, [compulsory/elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week 4. Lab work (Praktikum): 1x50'/week
Credit points (*SKS*)	4
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Through the Database Systems course, students learn data and information modeling and implement it into a database management system (DBMS) using DDL. Students also study relational algebra and normalization. Apart from that, in this course, students also manipulate data using DML and create database applications to manipulate data. Concepts and practices are carried out in class and laboratories both individually and in groups with case studies from the real world. *Melalui mata kuliah Sistem Basis Data, mahasiswa mempelajari pemodelan data dan informasi serta mengimplementasikannya ke dalam sistem manajemen basis data (DBMS) dengan menggunakan DDL. Mahasiswa juga mempelajari aljabar relasional dan normalisasi. Selain itu, pada mata kuliah ini, mahasiswa juga melakukan manipulasi data dengan menggunakan DML serta membuat aplikasi basis data untuk memanipulasi data. Konsep dan praktek dilakukan di*

	kelas dan laboratorium baik secara individu maupun kelompok dengan studi kasus dari dunia nyata.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to model data and information in the form of concept diagrams and physical diagrams and apply them to a database in a DBMS, both individually and in teamwork 2. Students are able to apply the concepts of relational algebra, DDL, and DML to manage data and information in databases 3. Students are able to design and manipulate data in a case study. *1. Mahasiswa mampu memodelkan data dan informasi dalam bentuk diagram konsep dan diagram fisik serta menerapkannya ke dalam basis data dalam suatu DBMS, baik secara individual maupun kerja sama tim* *2. Mahasiswa mampu menerapkan konsep aljabar relasional, DDL, dan DML untuk mengelola data dan informasi dalam basis data* *3. Mahasiswa mampu mendesain dan memanipulasi data pada sebuah studi kasus.*
Content (*Materi Pembelajaran*)	1. Information and database concept 2. Database modeling 3. Database normalization 4. Structured Query Language 5. Relational algebra *1. Konsep informasi dan basis data* *2. Pemodelan basis data* *3. Normalisasi basis data* *4. Structured Query Language* *5. Aljabar relasional*
Study and examination requirements and forms of examination	1. Assignments 2. Lab work 3. Midtest 4. Final exam *1. Tugas* *2. Praktikum* *3. Evaluasi Tengah Semester*

	4. Evaluasi Akhir Semester
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: - Ramakrishnan, Raghu, Gehrke, Johannes. 2003. Database Management Systems, Third Edition. New York: The McGraw-Hill Companies, Inc. - Howe, David; Data analysis for Database Design, third Edition, Butterworth-Heineman, 2001

Semester 2

Data Structure

Course (*Mata Kuliah*)	**Data Structure (*Struktur Data*)**
Code (*Kode Mata Kuliah*)	EF234201
Semester	2
Lecturer (*Dosen Pengampu*)	Ratih Nur Esti Anggraini
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	4
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Fundamental Programming (*Dasar Pemrograman*)
Course Description (*Deskripsi Mata Kuliah*)	Students will learn several related data structures and algorithms to organize (store, organize, and reserve) data sets on computers so that they can be used efficiently. Data abstraction is discussed to define a specific data structure (linear or non-linear) with some examples. Lab practice is done with the C/C++ programming language and is organized to implement appropriate data structures for various problem solving *Mahasiswa akan mempelajari beberapa struktur dan algoritma terkait untuk mengatur (menyimpan, mengatur, memesan) kumpulan data di komputer sehingga dapat digunakan secara efisien. Abstraksi data dibahas untuk mendefinisikan struktur data tertentu (linear atau non-linear) dengan beberapa contoh. Praktek lab dikerjakan dengan bahasa pemrograman C/C++ dan diatur untuk mengimplementasikan struktur data yang sesuai untuk berbagai pemecahan masalah*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to implement data access algorithms on static linear data structures (arrays) and dynamic (linked-list) to solve problems that consider the sequence of data input (FIFO, LIFO) using C / C ++ 2. Students are able to implement data access algorithms to solve problems in non-linear structures using C / C ++ 3. Students are able to implement a hash-table structure for big data access algorithms based on identifier data in solving problems using C / C ++ 1. *Mahasiswa mampu mengimplementasikan algoritma akses data pada struktur data linear statis (array) dan dinamis (linked-list) untuk menyelesaikan masalah yang mempertimbangkan urutan input data (FIFO, LIFO) dengan menggunakan C/C++* 2. *Mahasiswa mampu mengimplementasikan algoritma akses data untuk menyelesaikan masalah pada struktur non linier menggunakan C/C++* 3. *Mahasiswa mampu mengimplementasikan struktur hash-table untuk algoritma akses data besar berdasarkan data identifier dalam menyelesaikan masalah menggunakan C/C++*
Content (*Materi Pembelajaran*)	• Abstract Data Types • Linear Data Structures: Stack and Queue • Non-Linear Data Structures: Tree • Sorting and Searching Algorithms • Hash Table • *Tipe Data Abstrak* • *Struktur Data Linier: Stack dan Queue* • *Struktur Data Non-Linier: Tree* • *Algoritma Sorting dan Searching* • *Hash Table*
Study and examination requirements and forms of examination (*Prasyarat Studi*	1. Exercises 2. Quiz 3. Midtest

***dan Evaluasi serta Bentuk Evaluasi*)**	4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed (*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++ 4ed", Addison-Wesley, New Jersey, 2014 2. Robert Sedgewick, Philippe Flajolet, "An Introduction to the Analysis of Algorithms 2ed", Addison-Wesley, New Jersey, 2013 Supporting (*Pendukung*): 1. -

Operating System

Course (*Mata Kuliah*)	**Operating System (*Sistem Operasi*)**
Code (*Kode Mata Kuliah*)	EF234202
Semester	2
Lecturer (*Dosen Pengampu*)	• Dr. Wahyu Suadi, S.Kom., M.Kom. • Ir. Ary Mazharuddin Shiddiqi, S.Kom. M.Comp.Sc., Ph.D., IPM. • Bagus Jati Santoso, S.Kom., Ph.D. • Hudan Studiawan, S.Kom., M.Kom.,Ph.D. • Dr. Baskoro Adi Pratomo, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week 4. Practice (*Praktikum)*
Credit points (*SKS*)	4
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Organization (*Organisasi Komputer*)
Course Description (*Deskripsi Mata Kuliah*)	Through this course, students will learn about the basic concepts of operating systems and practice them. Lectures are conducted in class and practice is carried out in class and in the laboratory. Students will learn about the concept of operating systems along with their management and structure. *Melalui mata kuliah ini, mahasiswa akan belajar mengenai konsep dasar-dasar sistem operasi dan mempraktekkannya. Perkuliahan dilakukan di kelas dan praktik dilakukan di kelas maupun di laboratorium. Mahasiswa akan belajar tentang konsep sistem operasi beserta manajemen dan strukturnya.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and apply the basic concepts of operating systems and process life cycles and apply communication between processes 2. Students are able to understand and apply multiprocess and multithreaded synchronization mechanisms 3. Students are able to understand and apply memory management concepts, some page replacement algorithms, paging / segmentation mechanisms and apply several process scheduling algorithms 4. Students are able to understand the relationship between I/O hardware and I/O software and implement file systems *1. Mahasiswa mampu memahami dan menerapkan konsep dasar sistem operasi dan daur hidup proses dan menerapkan komunikasi antar proses* *2. Mahasiswa mampu memahami dan menerapkan mekanisme sinkronisasi multiproses dan multithread* *3. Mahasiswa mampu memahami dan menerapkan konsep manajemen memori, beberapa algoritma page replacement, mekanisme paging / segmentasi dan menerapkan beberapa algoritma penjadwalan proses* *4. Mahasiswa mampu memahami keterhubungan perangkat keras I/O dan perangkat lunak I/O dan menerapkan sistem berkas*
Content (*Materi Pembelajaran*)	• OS/Overview of Operating Systems • OS/Operating System Principles • OS/Threads • OS/Concurrency • OS/Scheduling and Dispatch • OS/Memory Management • OS/File Systems • *Ringkasan Sistem Operasi* • *Prinsip-prinsip dalam Sistem Operasi*

	• *Threads dalam Sistem Operasi* • *Kongkurensi dalam Sistem Operasi* • *Penjadwalan dan Penugasan dalam Sistem Operasi* • *Manajemen Memori dalam Sistem Operasi* • *Sistem Berkas dalam Sistem Operasi*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Stalling, William. 2005. Operating Systems (Internals and Design Principles), 5th Edition, Prentice Hall. 2. Tanenbaum, Andrew S. 2008. Modern Operating System, 3rd Edition, Upper Saddle River, NJ: Pearson Prentice Hall. Supporting (*Pendukung*): 1. Mitchell, M., Oldham, J., Samuel, A. 2001. Advanced Linux Programming, New Riders. 2. Wall, K., Watson, M., Whitis, M. 1999. Linux Programming Unleashed. 3. Watson, Devin. 2004. Linux Daemon Writing How To.

Computer Organization

Course (*Mata Kuliah*)	**Computer Organization (*Organisasi Komputer*)**
Code (*Kode Mata Kuliah*)	EF234203
Semester	2
Lecturer (*Dosen Pengampu*)	• Prof. Ir. Supeno Djanali, M.Sc Ph.D • Dr. Baskoro Adi Pratomo, S.Kom., M.Kom. • Dr. Wahyu Suadi, S.Kom., M.Kom. • Dr. Radityo Anggoro , S.Kom, M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Digital System (*Sistem Digital*)
Course Description (*Deskripsi Mata Kuliah*)	The Computer Organization course discusses the basics of how computers work, starting from what are the constituent components, how each component works, how, and how between these components interact. *Mata Kuliah Organisasi Komputer membahas dasar-dasar cara kerja komputer, mulai dari komponen-komponen penyusunnya apa saja, cara kerja masing-masing komponen bagaimana, dan bagaimana antar komponen tersebut berinteraksi.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the basic work of computers and their constituent components. 2. Students are able to explain the sequence of instructions executed on the CPU 3. Students are able to explain assembly language concepts and subroutines

	4. Students are able to explain the organization of input/output, how to access it, and the interface 5. Students are able to explain the basic concepts of memory systems on computers, Random Access Memory (RAM) and Read Only Memory (ROM) 6. Students are able to explain the concept of cache memory 7. Students are able to explain the basic concepts of unit processing and complete instruction execution 8. Students are able to explain the basic concepts of pipelining and superscalar operation 9. Students are able to explain the basic concepts of embedded systems and their use *1. Mahasiswa mampu menjelaskan dasar kerja komputer dan komponen pembentuknya.* *2. Mahasiswa mampu menjelaskan urutan instruksi dieksekusi pada CPU* *3. Mahasiswa mampu menjelaskan konsep bahasa assembly dan subroutine* *4. Mahasiswa mampu menjelaskan organisasi input/output, cara pengaksesannya, dan antar mukanya* *5. Mahasiswa mampu menjelaskan konsep dasar sistem memori pada komputer, Random Acces Memory (RAM) dan Read Only Memory (ROM)* *6. Mahasiswa mampu menjelaskan konsep cache memory* *7. Mahasiswa mampu menjelaskan konsep dasar unit processing dan eksekusi instruksi lengkap* *8. Mahasiswa mampu menjelaskan konsep dasar pipelining dan operasi superscalar* *9. Mahasiswa mampu menjelaskan konsep dasar embedded system dan penggunaannya*
Content (*Materi Pembelajaran*)	• Basic components of a computer • Instructions and their execution on the CPU • The concept of assembly language • Input/output organization • Memory • Cache • Processing Unit and Pipelining

	• *Komponen-komponen dasar komputer* • *Instruksi dan eksekusinya pada CPU* • *Konsep bahasa assembly* • *Organisasi input/output* • *Memori* • *Cache* • *Processing Unit dan Pipelining*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Supeno Djanali & Baskoro Adi P, "Organisasi Komputer", ITSPress, 2012. 2. Hamacher, Vranezic & Zaky, "Computer Organization 5th Edition", McGraw-Hill, 2002. 3. William Stallings, "Computer Organization And Architecture Designing for Performance, 8th Edition", Pearson Ed., 2010. 4. Hennessy & Patterson, " Computer Architecture A Quantitative Approach 5th Edition" Elsevier 2012. Supporting (*Pendukung*): 1. Morris Mano, "Computer System Architecture", Prentice-Hall, 1993

Numeric Computation

Course (*Mata Kuliah*)	**Numeric Computation (*Komputasi Numerik*)**
Code (*Kode Mata Kuliah*)	EF234204
Semester	2
Lecturer (*Dosen Pengampu*)	• Prof. Dr. Ir. Joko Lianto Buliali, M.Sc, • Dr. Ahmad Saikhu, S.Si., MT., • Dr. Bilqis Amaliah, S.Kom.,M.Kom, • Victor Hariadi, S.Si., M.Kom, • Arya Yudhi Wijaya, S.Kom, M.Kom
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Digital System (*Sistem Digital*)
Course Description (*Deskripsi Mata Kuliah*)	Students are able to analyze numerical problems and do computations to find solutions to approaches / appropriatives with the right method either independently or also in teamwork. *Mahasiswa mampu menganalisa permasalahan numerik dan melakukan komputasi untuk mencari solusi pendekatan/aproksimatif dengan metode yang benar baik secara mandiri atau juga dalam kerjasama tim.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to apply methods to proximate the roots of equations 2. Students are able to apply matching methods to approximate the shape and value of functions

	3. Students are able to apply methods to proximate the value of integration 4. Students are able to apply methods to proximate the value of various differentiation problems (ordinary or partial) *1. Mahasiswa mampu mengaplikasikan metode-metode untuk mengaproksimasi akar persamaan* *2. Mahasiswa mampu mengaplikasikan metode-metode pencocokan untuk mengaproksimasi bentuk maupun nilai fungsi* *3. Mahasiswa mampu mengaplikasikan metode-metode untuk mengaproksimasi nilai integrasi* *4. Mahasiswa mampu mengaplikasikan metode-metode untuk mengaproksimasi nilai berbagai persoalan diferensiasi (biasa maupun parsial)*
Content (*Materi Pembelajaran*)	• Introduction to Numerical Methods: Understanding Numerical Methods, Understanding "Meaningful Numbers", Understanding Accuracy and Precision, Understanding Rounding, Understanding "Errors", Taylor Series • Equation Roots (Akolade Method): Graph Method, Tabulation Method, Bolzano Method, Falsi Regula Method, Factorization Method, Bairstow Method, Quotient-Difference Method • Root Equation (Open Method) : Iteration Method, Newton-Raphson Method, Secant Method • Curve Matching (Least Squares Regression) : Introduction to Curve Matching, Linear Regression, Polynomial Regression, Non Linear Regression • Curve Matching (Interpolation): Finite Difference Concept, Newtonian Interpolation, Lagrange Interpolation, Gauss Interpolation, Stirling &; Bessel, Lagrange Interpolation, Spline Interpolation • Numerical Integration: Trapezoid Method, Simpson Method, Rhomberg Integration Method, Gaussian Quadrature Method, Weekly assignment • Ordinary Differential Equations (single step method): Euler-Cauchy method, Heun Single Step method, Picard method, Taylor method, Runge-Kutta method

	• Ordinary Differential Equations (multi-step method): Heun Multi Steps Method, Adam Method, Milne Method, Adam-Moulton Method • Partial Differential Equation: Elliptic PDP, Parabolic PDP, Hyperbolic PDP • *Pengantar Metode Numerik: Pengertian Metode Numerik, Pengertian "Bilangan Berarti", Pengertian Akurasi dan Presisi, Pengertian Pembulatan, Pengertian "Kesalahan", Deret Taylor* • *Akar Persamaan (Metode Akolade) : Metode Grafik, Metode Tabulasi, Metode Bolzano, Metode Regula Falsi, Metode Faktorisasi, Metode Bairstow, Metode Quotient-Difference* • *Akar Persamaan (Metode Terbuka) : Metode Iterasi, Metode Newton-Raphson, Metode Secant,* • *Pencocokan Kurva (Regresi Kuadrat Terkecil) : Pengantar Pencocokan Kurva, Regresi Linier, Regresi Polynomial, Regresi Non Linier* • *Pencocokan Kurva (Interpolasi) : Konsep Beda Hingga, Interpolasi Newton, Interpolasi Lagrange, Interpolasi Gauss, Stirling & Bessel, Interpolasi Lagrange, Interpolasi Spline,* • *Integrasi Numerik: Metode Trapezoida, Metode Simpson, Metode Integrasi Rhomberg, Metode Kuadratur Gauss* • *Persamaan Differensial Biasa (metode langkah tunggal): Metode Euler-Cauchy, Metode Heun Single Step, Metode Picard, Metode Taylor, Metode Runge-Kutta* • *Persamaan Differensial Biasa (metode multi langkah): Metode Heun Multi Steps, Metode Adam, Metode Milne, Metode Adam-Moulton* • *Persamaan Differensial Parsial: PDP Elliptik, PDP Parabolik, PDP Hiperbolik*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam

	1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Chapra, S.C, Canale, R.P., Numerical Methods for Engineers, McGraw Hill, 2020 2. Novak, K.A., Numerical Methods for Scientific Computing, Lulu.com, 2018 3. Chapra, S.C., Applied Numerical Method with MATLAB for Engineers and Sciencetists 4th Edition, McGraw Hill, 2017 Supporting (*Pendukung*):

Calculus 2

Course (*Mata Kuliah*)	**Calculus 2 (*Kalkulus 2*)**
Code (*Kode Mata Kuliah*)	SM234201
Semester	2
Lecturer (*Dosen Pengampu*)	• Dr. Tahiyatul Asfihani, S.Si, M.Si • Prof. Dr. Drs. Chairul Imron, M.Ikom • M. Syifa'ul Mufid, S.Si, M.Si, Ph.D • Dian Winda S., S.Si, M.Si • Amirul Hakam, S.Si, M.Si
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Calculus 1 (*Kalkulus 1*)
Course Description (*Deskripsi Mata Kuliah*)	In this course, students will learn the following subjects: 1. Trancendents functions, differential and integral. 2. Integration technique and improper integral. 3. Applicating certain integral to a plane area, the volume of area revolution, arc length and the area of a surface of revolution., centroids and application of Guldin's theorem. 4. Polar coordinate system and parametric equation, the polar coordinate's graph, and its application. 5. Convergence of sequences and infinite series, sums of infinite series, Taylor and Maclaurin series. *Dalam mata kuliah ini, siswa akan mempelajari materi berikut:* *1. Fungsi trancendent, diferensial dan integral.*

	2. Teknik integrasi dan integral yang tidak benar. *3. Menerapkan integral tertentu ke luas bidang, volume revolusi luas, panjang busur dan luas permukaan revolusi., sentroid dan penerapan teorema Guldin.* *4. Sistem koordinat polar dan persamaan parametrik, grafik koordinat polar, dan aplikasinya.* *5. Konvergensi urutan dan deret tak terbatas, jumlah deret tak terbatas, deret Taylor dan Maclaurin.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to apply basic mathematical concepts related to transcendent functions 2. Students are able to apply integration techniques 3. Students are able to apply integration techniques well in the forms of cartesian coordinate functions, polar coordinate, and parametric equations 4. Students are able to determine the convergence of infinity sequences and series. *1. Mahasiswa mampu menerapkan konsep-konsep dasar matematika yang terkait dengan fungsi transenden* *2. Mahasiswa mampu menerapkan teknik integrasi* *3. Mahasiswa mampu mengaplikasikan integral pada bentuk fungsi koordinat kartesius, koordinat kutub dan persamaan parametrik* *4. Mahasiswa mampu menentukan kekonvergenan barisan dan deret tak hingga*
Content (*Materi Pembelajaran*)	• Transcendent, differential and integral functions • Integration Techniques, Unnatural Integrals • Integral Applications • Polar shape, Parametric functions, their differentials and integrals • Sequences and Series • *Fungsi transenden, diferensial dan integralnya* • *Teknik Integrasi, Integral tak wajar* • *Aplikasi Integral* • *Bentuk Kutub, fungsi Parametrik, diferensial dan integralnya* • *Barisan dan Deret*

Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Tim Dosen Departemen Matematika ITS, Buku Ajar Matematika 2 , Edisi ke-2 (Revisi 2022) Departemen Matematika ITS, 2022 2. Anton, H. dkk, Calculus, 10-th edition, John Wiley & Sons, New York, 2012 Supporting (*Pendukung*): 1. Kreyzig, E, Advanced Engineering Mathematics, 10-th edition, John Wiley & Sons, Singapore, 2011 2. Purcell, J, E, Rigdon, S., E., Calculus, 9-th edition, Prentice-Hall, New Jersey, 2006 3. James Stewart , Calculus, ed.7, Brooks/cole-Cengage Learning, Canada,2012

Introduction to Intelligent Electrical and Informatics Technology

Course (*Mata Kuliah*)	**Introduction to Intelligent Electrical and Informatics Technology (*Pengenalan Teknologi Elektro dan Informatika Cerdas*)**
Code (*Kode Mata Kuliah*)	EW234201
Semester	2
Lecturer (*Dosen Pengampu*)	•
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	
Content (*Materi Pembelajaran*)	•
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): Supporting (*Pendukung*):

Semester 3

Web Programming

Course (*Mata Kuliah*)	**Web Programming (*Pemrograman Web*)**
Code (*Kode Mata Kuliah*)	EF234301
Semester	3
Lecturer (*Dosen Pengampu*)	Fajar Baskoro, S.Kom., M.T.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Database System (*Sistem Basis Data*)
Course Description (*Deskripsi Mata Kuliah*)	This course introduces programming concepts using a web platform for students who already have knowledge of structured programming and object programming. Topics include the principles of web technologies and their use to create applications. *Mata kuliah ini memperkenalkan konsep pemrograman menggunakan platform web untuk mahasiswa yang telah memiliki pengetahuan pemrograman terstruktur, dan pemrograman obyek. Topik-topik mencakup prinsip-prinsip teknologi web dan penggunaanya untuk membuat aplikasi.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain web programming concept. 2. Students are able to analyze problems using web approach. 3. Students are able to model problem solutions using a web application approach. 4. Students are able to implement and host solutions from web applications that are built.

	1. *Mahasiswa mampu menjelaskan konsep pemrograman web.* 2. *Mahasiswa mampu menganalisis permasalahan menggunakan pendekatan web.* 3. *Mahasiswa mampu memodelkan solusi permasalahan menggunakan pendekatan aplikasi web.* 4. *Mahasiswa mampu mengimplementasikan dan menghosting solusi dari aplikasi web yang dibangun.*
Content (*Materi Pembelajaran*)	• Introduction to Web Technology • Create a simple application with HTML • Cascading Style Sheet Front End Web Layout • Front End and Back End • Make simple programming with CRUD • Get to know Java Script • Create applications with JS • Create an Online Store Front End • Building the Back End • Get to know Bootstrap • Ajax Technology • Data and Queries • Create Reports • Web reporting application • Web application case study 1 - document management • Document Management 2 • *Pengenalan Teknologi Web* • *Membuat aplikasi sederhana dengan HTML* • *Layout Web Front End Cascading Style Sheet* • *Front End dan Back End* • *Membuat pemrograman sederhana dengan CRUD* • *Mengenal Java Script* • *Membuat aplikasi dengan JS* • *Membuat Front End Toko Online* • *Membangun Back End* • *Mengenal Bootstrap* • *Teknologi Ajax* • *Data dan Query* • *Membuat Report*

	• *Aplikasi web reporting* • *Studi kasus aplikasi web 1 - manajemen dokumen* • *Manajemen Dokumen 2*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. "HTML and CSS: Design and Create Websites" by Jon Duckett. 2. "HTML, CSS, and JavaScript All in One" by Julie C. Meloni. 3. "PHP Objects, Patterns, and Practice" by Matt Zandstra. 4. "Bootstrap 4: A Comprehensive Guide to Building Responsive Websites and Web Applications" by David East. Supporting: 1. "HTML5 and CSS3: Develop with Tomorrow's Standards Today" by Raphaël Goetter. 2. "Web Design with HTML, CSS, JavaScript and jQuery" by Jon Duckett. 3. "PHP and MySQL Web Development" by Luke Welling and Laura Thomson. 4. "Modern PHP: New Features and Good Practices" by Josh Lockhart.

Object Oriented Programming

Course (*Mata Kuliah*)	**Object Oriented Programming (*Pemrograman Berorientasi Obyek*)**
Code (*Kode Mata Kuliah*)	EF234302
Semester	3
Lecturer (*Dosen Pengampu*)	Misbakhul Munir Irfan Subakti, S.Kom., M.Sc. Fajar Baskoro, S.Kom., M.T. Rizky Januar Akbar, S.Kom., M.Eng. Agus Budi Raharjo, S.Kom, M.Kom., Ph.D.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Data Structure (*Struktur Data*)
Course Description (*Deskripsi Mata Kuliah*)	This course introduces the concept of object oriented programming for students who already have knowledge of structured or procedural programming (mainly, the C/C++ programming language). Topics taught include object oriented principles and object oriented programming techniques using object oriented languages (mainly, the Java programming language). *Mata kuliah ini memperkenalkan konsep pemrograman berorientasi obyek untuk mahasiswa yang telah memiliki pengetahuan pemrograman terstruktur atau prosedural (utamanya, bahasa pemrograman C/C++). Topik-topik yang diajarkan mencakup prinsip-prinsip orientasi obyek dan teknik pemrograman berorientasi obyek menggunakan bahasa yang berorientasi objek (utamanya, bahasa pemrograman Java).*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the concept of object based programming along with the features of object oriented programming languages. 2. Students are able to analyze problems using an object oriented approach. 3. Students are able to model problem solutions using an object oriented approach. 4. Students are able to implement problem solutions in the form of programs using object oriented language. 1. *Mahasiswa mampu menjelaskan konsep pemrograman berbasis obyek beserta fitur-fitur bahasa pemrograman berorientasi obyek.* 2. *Mahasiswa mampu menganalisis permasalahan menggunakan pendekatan berorientasi obyek.* 3. *Mahasiswa mampu memodelkan solusi permasalahan menggunakan pendekatan berorientasi obyek.* 4. *Mahasiswa mampu mengimplementasikan solusi permasalahan dalam bentuk program menggunakan bahasa berorientasi obyek.*
Content (*Materi Pembelajaran*)	• Introduction & Getting Started • Eclipse IDE for Java Programming • Eclipse IDE: Debugging, Classes and Objects, Types, Conditions and loops, Exercises • Arrays, ArrayLists & Scanners; Exceptions and I/O • Javadoc, Testing & Objects, Interfaces • Inheritance • Collections & Generics • Graphical User Interface (GUI), Event Handler & Inner Class • Access control & polymorphism, GUI programming & MVC design patterns • Collections: Advanced & Immutability • Threads, races & deadlock-livelock • Socket & Project Team • *Pendahuluan & Memulai* • *Eclipse IDE untuk Pemrograman Java*

	• *Eclipse IDE: Debugging, Classes dan Objects, Types, Berbagai kondisi dan perulangan, Latihan-latihan* • *Array, ArrayList & Scanner; Exception dan I/O* • *Javadoc, Testing & Objects, Interface* • *Inheritance* • *Collection & Generics* • *Graphical User Interface (GUI), Penangan Event & Inner Class* • *Kontrol akses & polymorphism, Pemrograman GUI & pola desain MVC* • *Collections: Lanjutan & Immutability* • *Thread, race & deadlock-livelock* • *Socket & Proyek Tim*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Murach, J. and Urban, M. (2015) Murach's Beginning Java with Eclipse. Fresno, CA, USA: Mike Murach & Associates, Inc. 2. Deitel, P. and Deitel, H. (2020) JavaTM—How to Program—Late Objects. Eleventh Edition. Global Edition. New Yok, USA: Pearson Education Limited. Supporting: 1. MM Irfan Subakti—Object Oriented Programming Course: The Lectures (2022). (Available: www.subakti.com)

Computer Network

Course (*Mata Kuliah*)	**Computer Network (*Jaringan Komputer*)**
Code (*Kode Mata Kuliah*)	EF234303
Semester	3
Lecturer (*Dosen Pengampu*)	Bagus Jati Santoso, S.Kom., Ph.D. Hudan Studiawan, S.Kom., M.Kom., Ph.D. Dr. Baskoro Adi Pratomo, S.Kom., M.Kom. Royyana Muslim Ijtihadie, S.Kom., M.Kom., Ph.D.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week 4. Lab Work (*Praktikum*): 1x50' /week
Credit points (*SKS*)	4
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Operating System (*Sistem Operasi*)
Course Description (*Deskripsi Mata Kuliah*)	Computer Networks courses provide students with a theoretical basis, knowledge, and skills about computer networks. A technology that allows information technology devices to connect with each other to exchange data and information. *Kuliah Jaringan Komputer memberikan dasar teoretis, pengetahuan, dan ketrampilan kepada mahasiswa tentang jaringan computer. Sebuah teknologi yang memungkinkan perangkat teknologi informasi dapat terhubung antara satu dengan lainnya untuk melakukan pertukaran data dan informasi.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and master the concepts and principles of architecture, systems, and the basics of computer networks.

	2. Students are able to study and utilize science and technology in order to apply it to the field of computer networks. 3. Students are able to design, implement, and manage network systems that have high performance, safe and efficient. 4. Students master the theoretical concepts and principles of network based computing and the latest technology related to it. *1. Mahasiswa mampu memahami dan menguasai konsep dan prinsip arsitektur, sistem, dan dasar-dasar jaringan komputer.* *2. Mahasiswa mampu mengkaji dan memanfaatkan ilmu pengetahuan dan teknologi dalam rangka mengaplikasikannya pada bidang jaringan komputer.* *3. Mahasiswa mampu merancang, mengimplementasikan, dan mengelola sistem jaringan yang mempunyai kinerja tinggi, aman, dan efisien.* *4. Mahasiswa menguasai konsep teoritis dan prinsip-prinsip tentang komputasi berbasis jaringan dan teknologi terkini yang terkait dengannya.*
Content (*Materi Pembelajaran*)	• Introduction • Networked Applications • Reliable Data Delivery • Local Area Networks • Resource Allocation • Mobility • Routing And Forwarding • *Perkenalan* • *Aplikasi Jaringan* • *Pengiriman Data yang Andal* • *Jaringan Area Lokal* • *Alokasi sumber daya* • *Mobilitas* • *Routing dan Forwarding*

Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. James F. Kurose and Keith W. Ross, Computer Networking: A Top-Down Approach, 7th Edition, Addison Wesley, 2013. 2. Andrew S. Tanenbaum and David J. Etherall, Computer Networks, 5th Edition, Prentice Hall, 2011. Supporting: -

Graph Theory

Course (*Mata Kuliah*)	**Graph Theory (*Teori Graf*)**
Code (*Kode Mata Kuliah*)	EF234304
Semester	3
Lecturer (*Dosen Pengampu*)	Arya Yudhi Wijaya, S.Kom, M.Kom. Victor Hariadi, S.Si., M.Kom. Dr. Ahmad Saikhu, S.Si., MT. Prof. Dr. Ir. Joko Lianto Buliali, M.Sc. Dr. Bilqis Amaliah, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Calculus 2 (*Kalkulus 2*)
Course Description (*Deskripsi Mata Kuliah*)	This course explains knowledge of methods that can be used to solve real problems in graph form. *Mata kuliah ini menjelaskan pengetahuan terhadap metode-metode yang dapat digunakan menyelesaikan permasalahan-permasalahan riil dalam bentuk graf.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students can explain the basics of graphs including: graph components, tree, paths and circuits. 2. Students are able to implement basic optimization problems on graphs including: shortest path, minimum spanning tree, Traveling Salesman Problem, and Chinese Postman Problem. 3. Students can explain advanced graph concepts including: planarity, graph coloring, graph matching, and connectivity. 4. Students are able to implement advanced graph optimization problems including: Scheduling, Person

	Assignment Problems, and Maximum Bipartite Matching. 1. *Mahasiswa dapat menjelaskan dasar-dasar graf meliputi: komponen graf, tree, lintasan dan Sirkuit.* 2. *Mahasiswa mampu mengimplementasikan permasalahan optimasi dasar pada graf meliputi: lintasan terpendek, minimum spanning tree, Traveling Salesman Problem, dan Chinese Postman Problem.* 3. *Mahasiswa dapat menjelaskan konsep graf lanjut meliputi: planaritas, pewarnaan graf, pencocokan graf, dan konektivitas.* 4. *Mahasiswa mampu mengimplementasikan permasalahan optimasi graf lanjut meliputi: Penjadwalan, Permasalahan Penugasan Person, dan Maximum Bipartite Matching.*
Content (*Materi Pembelajaran*)	• The basics of graphs include: graph components, trees, paths, and circuits. • Basic optimizations of graphs include: shortest path, minimum spanning tree, Traveling Salesman Problem, and Chinese Postman Problem. • Advanced graph concepts include: planarity, graph coloring, graph matching, and connectivity. • Advanced graph optimizations include: Scheduling, Person Assignment Problems, and Maximum Bipartite Matching. • *Dasar-dasar graf meliputi: komponen graf, tree, lintasan, dan Sirkuit.* • *Optimasi dasar pada graf meliputi: lintasan terpendek, minimum spanning tree, Traveling Salesman Problem, dan Chinese Postman Problem.* • *Konsep graf lanjut meliputi: planaritas, pewarnaan graf, pencocokan graf, dan konektivitas.* • *Optimasi graf lanjut meliputi: Penjadwalan, Permasalahan Penugasan Person, dan Maximum Bipartite Matching.*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest

	4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Diestel, R., Graph Theory, 2005, Springer-Verlag. 2. Vasudev C, Graph Theory with Apllication, 2006, New Age International Publisher. Supporting: 1. McHugh, J.A., Algorithmic Graph Theory, 1990, Prentice-Hall Inc. 2. Liotta, G., Tamassia, R., Tollis, I., Graph Algorithms and Applications 2, 2004, World Scientific Pub.

Discrete Mathematics

Course (*Mata Kuliah*)	**Discrete Mathematics (*Matematika Diskrit*)**
Code (*Kode Mata Kuliah*)	EF234305
Semester	3
Lecturer (*Dosen Pengampu*)	Arya Yudhi Wijaya, S.Kom, M.Kom. Dr. Bilqis Amaliah, S.Kom., M.Kom. Victor Hariadi, S.Si., M.Kom. Dr. Ahmad Saikhu, S.Si., MT. Prof. Dr. Ir. Joko Lianto Buliali, M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Calculus 2 (*Kalkulus 2*)
Course Description (*Deskripsi Mata Kuliah*)	The material in the Discrete Mathematics course teaches students to master the concepts of logic, proof methods, sets, functions, mathematical induction & recursion, relations and can apply them to real problems, both with individual performance and in groups in team collaboration. mastering various kinds of storage structures, structuring and managing lots of data and related algorithms. *Materi dalam Mata Kuliah Matematika Diskrit mengajarkan mahasiswa untuk menguasai konsep logika, metode pembuktian, himpunan, fungsi, induksi matematis & rekursi, relasi dan dapat mengaplikasikannya pada permasalahan nyata, baik dengan kinerja individu maupun secara berkelompok dalam kerjasama tim. menguasai berbagai macam*

	struktur penyimpanan, penyusunan dan pengaturan banyak data serta algoritma terkait.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain logical concepts and draw conclusions. 2. Students are able to apply proof methods. 3. Students apply the concepts of sets and functions. 4. Students apply recursion to real problems. *1. Mahasiswa mampu menjelaskan konsep logika dan penarikan kesimpulan.* *2. Mahasiswa mampu mengaplikasikan metode-metode pembuktian.* *3. Mahasiswa mengaplikasikan konsep himpunan dan fungsi.* *4. Mahasiswa mengaplikasikan rekursi pada permasalahan nyata.*
Content (*Materi Pembelajaran*)	• Logic • Set Theory • Relations and Functions • Algorithm • Sequence and Series • Generating and Recursive Functions • *Logika* • *Teori Himpunan* • *Relasi dan Fungsi* • *Algoritma* • *Baris dan Deret* • *Fungsi Pembangkit dan Rekuren*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main:

	1. Kenneth Rosen, “Discrete Mathematics and Its Applications 8th Edition”. 2018. Mc Graw-Hill. Supporting: 1. Andrew Simpson, “Discrete Mathematics by Example”, McGraw-Hill Incorporated, New York, 2002. 2. Norman L. Biggs, “Discrete Mathematics”, Oxford University Press, 2002.

Artificial Intelligence Concepts

Course (*Mata Kuliah*)	**Artificial Intelligence Concepts (*Konsep Kecerdasan Artifisial*)**
Code (*Kode Mata Kuliah*)	EK234201
Semester	3
Lecturer (*Dosen Pengampu*)	Shintami Chusnul Hidayati, S.Kom., M.Sc., Ph.D.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Data Structure (*Struktur Data*)
Course Description (*Deskripsi Mata Kuliah*)	This course seeks to understand the mechanisms underlying thought and intelligent behavior, with a particular focus on their embodiment in machines. Key topics include its historical development, theoretical underpinnings, basic architecture, modern applications, and ethical implications. The course explores the trajectory of AI in the future and examines how it might advance society while pointing out its drawbacks and limitations. *Mata kuliah ini bertujuan untuk memberi pemahaman mengenai mekanisme yang mendasari pemikiran dan perilaku cerdas, dengan fokus khusus pada perwujudannya dalam mesin. Topik utama meliputi perkembangan historisnya, landasan teoretis, arsitektur dasar, aplikasi modern, dan implikasi etis. Mata kuliah ini mengeksplorasi jejak KA di masa depan dan mempertimbangkan potensinya untuk memajukan masyarakat dengan menyoroti kekurangan dan keterbatasannya.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the concept of artificial intelligence compared to human intelligence. 2. Students are able to formulate problems based on the concepts in mathematics and logic that underlie artificial intelligence. 3. Students are able to apply the concepts, components, and uses of expert systems to find solutions to a problem. 4. Students are able to apply the concepts, components, and uses of metaheuristics optimization to estimate the unknown parameters. 5. Students are able to understand the role of data science and machine learning in artificial intelligence. 6. Students are able to understand testing on artificial intelligence systems. 1. *Mahasiswa mampu memahami konsep kecerdasan artifisial dibandingkan kecerdasan manusia.* 2. *Mahasiswa mampu merumuskan masalah berdasarkan konsep-konsep dalam matematika dan logika yang mendasari kecerdasan artifisial.* 3. *Mahasiswa mampu menerapkan konsep, komponen, dan kegunaan sistem pakar untuk menemukan solusi dari suatu masalah.* 4. *Mahasiswa mampu menerapkan konsep, komponen, dan penggunaan optimasi metaheuristik untuk mengestimasi parameter yang tidak diketahui.* 5. *Mahasiswa mampu memahami peranan data sains dan machine learning pada kecerdasan artifisial.* 6. *Mahasiswa mampu memahami pengujian pada sistem kecerdasan artifisial.*
Content (*Materi Pembelajaran*)	• The concept of artificial intelligence versus human intelligence • The fundamental mathematical and logical ideas behind AI • Expert systems • Problem-solving by search • Metaheuristic optimization

	• Role of data science and machine learning in artificial intelligence • Testing artificial intelligence systems • *Konsep kecerdasan buatan melawan kecerdasan manusia* • *Ide dasar matematika dan logika di balik AI* • *Sistem pakar* • *Pemecahan masalah dengan pencarian* • *Optimasi metaheuristik* • *Peran ilmu data dan pembelajaran mesin dalam kecerdasan artifisial* • *Menguji sistem kecerdasan artifisial*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Stuart Russell and Peter Norvig (2016). Artificial Intelligence: A Modern Approach. Pearson Education. ISBN: 978-0-13-604259-4. 2. Wolfgang Ertel (2018). Introduction to Artificial Intelligence. Springer Cham. ISBN: 978-3-319-58487-4. Supporting: 1. Stuart Russell (2019). Human Compatible: Artificial Intelligence and the Problem of Control. Penguin Publishing Group. ISBN: 978-0-52-555862-0. 2. Zixing Cai, Lijue Liu, Baifan Chen, and Yong Wang (2021). Artificial Intelligence from Beginning to Date. Tsinghua University Press. ISBN: 978-9-81-122371-6.

Software Development Principles

Course (*Mata Kuliah*)	**Software Development Principles (*Konsep Pengembangan Perangkat Lunak*)**
Code (*Kode Mata Kuliah*)	EF234307
Semester	3
Lecturer (*Dosen Pengampu*)	Sarwosri, S.Kom. M.T. Ir. Siti Rochimah, MT., Ph.D.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This course contains what processes exist in software engineering, various process models in software engineering, how agility principles are applied to the software engineering process, and process stages in software engineering. *Mata kuliah ini berisi proses-proses apa saja yang ada dalam rekayasa perangkat lunak, macam-macam model proses dalam rekayasa perangkat lunak, bagaimana prinsip ketangkasan diterapkan pada proses rekayasa perangkat lunak, dan tahapan proses dalam rekayasa perangkat lunak.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand software processes. 2. Students are able to understand software process models. 3. Students are able to implement agility in software processes. 4. Students are able to understand the stages in software engineering development.

	1. *Mahasiswa mampu memahami proses perangkat lunak.* 2. *Mahasiswa mampu memahami model proses perangkat lunak.* 3. *Mahasiswa mampu mengimplementasikan ketangkasan pada proses perangkat lunak.* 4. *Mahasiswa mampu memahami tahapan dalam pengembangan rekayasa perangkat lunak.*
Content (*Materi Pembelajaran*)	• Software Process and Software Process Model • Agility and Process • Software Development Life Cycle • *Proses Perangkat Lunak dan Model Proses Perangkat Lunak* • *Ketangkasan dan Proses* • *Siklus Hidup Pengembangan Perangkat Lunak*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Software Engineering A Practitioner's Approach, Roger S. Pressman, Bruce R. Maxim, 9th 2019. Supporting: 1. Software Engineering, Ian Sommerville, 10th 2016.

Semester 4

Network Programming

Course (*Mata Kuliah*)	**Network Programming (*Pemrograman Jaringan*)**
Code (*Kode Mata Kuliah*)	EF234401
Semester	4
Lecturer (*Dosen Pengampu*)	Bagus Jati Santoso, S.Kom, Ph.D
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The Network Programming course provides knowledge and skills to students on how to create applications that can communicate with other applications on a computer network using socket programming. In addition, students also learn how to communicate between applications. *Kuliah Pemrograman Jaringan memberikan pengetahuan dan ketrampilan kepada mahasiswa tentang bagaimana membuat aplikasi yang bisa berkomunikasi dengan aplikasi lain pada jaringan komputer dengan menggunakan socket programming. Selain itu mahasiswa juga belajar cara komunikasi antar aplikasi.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and explain the concepts and principles of architecture, systems and the basics of computer networks based on logic systems. 2. Students are able to understand and explain the concepts and principles of network-based computing and the latest technology related to it. 3. Students are able to understand and explain the principles of making an algorithm and various programming language concepts. 4. Students are able to understand and explain the application of network-based programming models to solve problems effectively and efficiently. *1. Mahasiswa mampu memahami dan menjelaskan konsep dan prinsip arsitektur, sistem dan dasar - dasar jaringan komputer berbasis sistem logika.* *2. Mahasiswa mampu memahami dan menjelaskan konsep dan prinsip-prinsip komputasi berbasis jaringan dan teknologi terkini yang terkait dengannya.* *3. Mahasiswa mampu memahami dan menjelaskan prinsip-prinsip pembuatan suatu algoritma dan berbagai macam konsep bahasa pemrograman.* *4. Mahasiswa mampu memahami dan menjelaskan pengaplikasian model-model pemrograman berbasis jaringan untuk menyelesaikan permasalahan secara efektif dan efisien.*
Content (*Materi Pembelajaran*)	1. AL/Algorithmic Strategies 2. AL/Fundamental Data Structures and Algorithms 3. NC/Networked Applications 4. NC/Reliable Data Delivery 5. NC/Resource Allocation 6. OS/Overview of Operating Systems 7. OS/Operating System Principles 8. OS/Concurrency 9. PL/Object-Oriented Programming 10. PL/Advanced Programming Constructs 11. PL/Concurrency and Parallelism

	12. PL/Logic Programming *1. AL/Strategi Algoritmik* *2. AL/Struktur Data dan Algoritma Dasar* *3. NC/Aplikasi Jaringan* *4. NC/Pengiriman Data yang Andal* *5. NC/Alokasi Sumber Daya* *6. OS/Gambaran Umum Sistem Operasi* *7. OS/Prinsip-prinsip Sistem Operasi* *8. OS/Konkurensi* *9. PL/Pemrograman Berorientasi Objek* *10. PL/Konstruksi Pemrograman Tingkat Lanjut* *11. PL/Konkurensi dan Paralelisme* *12. PL/Pemrograman Logika*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff,"Unix Network Programming Vol.1 3rd Edition",Addision Wesley, 2003. 2. Nathan Yocom, John Turner, Keir Davis," The Definitive Guide to Linux Network Programming", Appress, 2004 Supporting: 1. Elliotte Rusty Harold," Java Network Programming 3rd Edition", O'Reilly Media, 2004. 2. Brandon Rhodes, John Goerzen, "Foundations of Python Network Programming", Appress, 2013.

Probabilistic and Statistic

Course (*Mata Kuliah*)	**Probabilistic and Statistic (*Probabilitas dan Statistik*)**
Code (*Kode Mata Kuliah*)	EF234402
Semester	4
Lecturer (*Dosen Pengampu*)	1. Ahmad Saikhu 2. Joko Lianto Buliali 3. Bilqis Amaliah 4. Arya Yudhi Wijaya 5. Victor Hariadi
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Calculus 2 (*Kalkulus 2*)
Course Description (*Deskripsi Mata Kuliah*)	This course explains the strong skills and knowledge to formulate and solve stochastic event problems, modeling as random variables and calculating their chance values using tables, functions and graphs, both discrete and continuous random variables. Students are also able to apply the concept of expectation to calculate correlation values for discrete and continuous random variables. Students are also able to estimate single and multiple population parameters using inference statistics.

	Mata kuliah ini menjelaskan keterampilan dan pengetahuan yang kuat untuk merumuskan dan memecahkan masalah kejadian yang bersifat stokastik, memodelkan sebagai variabel random dan perhitungan nilai peluangnya menggunakan tabel, fungsi dan grafik, baik variabel random diskrit maupun kontinu. Mahasiswa juga mampu menerapkan konsep ekspektasi untuk menghitung nilai korelasi untuk variabel random diskrit dan kontinu. Mahasiswa juga mampu melakukan estimasi parameter populasi tunggal dan multi dengan mengggunakan statistika inferensia.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students can model the probability of a random experiment with Bayes theory and the probability density function of a random variable. 2. Students can explain the concepts of expectation, variance, co-variance and can calculate the correlation value. 3. Students are able to calculate estimators of population parameters through estimation, hypothesis testing and can draw conclusions. 4. Students are able to conduct hypothesis testing of population parameters of more than 2 groups and draw conclusions. 4. 1. *Mahasiswa dapat membuat model probabilitas dari suatu percobaan random dengan teori bayes dan fungsi padat probilitas dari variabel random.* 2. *Mahasiswa dapat menjelaskan konsep ekspektasi, variansi, ko-variansi dan dapat menghitung nilai korelasi.* 3. *Mahasiswa dapat menghitung estimator dari parameter populasi melalui estimasi, uji hipotesis dan dapat mengambil kesimpulan.* 4. *Mahasiswa dapat melakukan uji hipotesis dari parameter populasi lebih dari 2 grup dan mengambil kesimpulan*
Content (*Materi Pembelajaran*)	1. Sample Space, Event Space and Probability, Bayes Formula.

	2. Random Variables, Solid Functions Discrete and Continuous, singular and composite probabilities. 3. Expectation and Correlation 4. Estimation of parameters of single and multiple populations. 5. Hypothesis Testing and ANOVA *1. Ruang Sampel, Ruang Kejadian dan Peluang, Formula Bayes.* *2. Variabel Random, Fungsi Padat Probabilitas diskrit dan Kontinu, tunggal dan gabungan.* *3. Ekspektasi dan Korelasi* *4. Estimasi parameter populasi tunggal dan multi.* *5. Uji Hipotesis dan ANOVA*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Ronald E.Walpole, Raymond H.Myers, “Probability & Statistics for Engineers & Scientists”, 9th Edition, Prentice-Hall Inc., 2010. 2. Michael Baron, “Probability & Statistics for Computer Scientists”, Chapman & Hall, 2007. 3. Sheldon Ross, “A First Course in Probability”, Prentice Hall, 9th Edition, 2012. Supporting: 1. Arak M. Mathai and Hans J. Haubold, "Probability and Statistics, A Course for Physicists and Engineers", published by Walter de Gruyter GmbH, Berlin/Boston 2018.

Automata

Course (*Mata Kuliah*)	**Automata (*Otomata*)**
Code (*Kode Mata Kuliah*)	EF234403
Semester	4
Lecturer (*Dosen Pengampu*)	1. Joko Lianto Buliali 2. Ahmad Saikhu 3. Bilqis Amaliah 4. Victor Hariadi 5. Arya Yudi Wijaya
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Students are taught to recognize various language recognition and definition tools. They are also taught to be able to perform the conversion process between language identifiers/definition tools. *Mahasiswa diajarkan untuk mengenal berbagai macam alat pengenal dan pendefinisi bahasa. Serta diajarkan untuk mampu melakukan proses konversi antar alat pengenal/pendefinisi bahasa.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to represent and operate languages using regular expressions. 2. Students are able to represent and operate languages using automata machines in its various variants (deterministic, non-deterministic, automata with output, pushdown automata, turing machines) 3. Students are able to perform language conversion between language defining tools 4. Students are able to recognize types and operate grammars *1. Mahasiswa mampu merepresentasi dan mengoperasikan bahasa menggunakan regular expression* *2. Mahasiswa mampu merepresentasi dan mengoperasikan bahasa menggunakan mesin otomata dalam berbagai variannya (deterministik, non deterministic, otomata dengan luaran, pushdown automata, mesin turing)* *3. Mahasiswa mampu melakukan konversi bahasa antar alat pendefinisi bahasa* *4. Mahasiswa mampu mengenali jenis-jenis dan mengoperasikan grammar*
Content (*Materi Pembelajaran*)	1. Language theory and its supporting mathematical operations 2. Regular expressions 3. Basic automata (deterministic finite automata and transition graph) 4. Automata with output 5. Non Deterministic Automata 6. Kleene's theorem 7. Introduction to Grammar with some of its classes 8. Normalization of grammars 9. Pushdown Automata 10. Turing Machine *1. Teori bahasa dan operasi-operasi matematika pendukungnya*

	2. Regular expression *3. Basic automata (deterministic finite automata dan transition graph)* *4. Automata with output* *5. Non Deterministic Automata* *6. Teorema Kleene* *7. Pengenalan Grammar dengan beberapa klasnya* *8. Normalisasi grammar* *9. Pushdown Automata* *10. Mesin Turing*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Rathinasamy, K., Duraisamy, C., Introduction to Finite Automata and Regular Expression, Lambert Academic Publishing, 2018 2. Maguluri L.P., Syamala M., Buhsanam V.N., The Art of Automata Theory and Formal Languages, Lambert Academic Publishing, 2018 3. Salomaa, A., Sneddon I.N., Stark, M., Kahane J.P., Theory of Automata, Pergamon, 2014 Supporting: 1. Hollos, S., Hollos, J.R., Finite Automata and Regular Expressions: Problems and Solutions, Abrazol Publishing, 2013

Database Management

Course (*Mata Kuliah*)	**Database Management (*Manajemen Basis Data*)**
Code (*Kode Mata Kuliah*)	EF234404
Semester	4
Lecturer (*Dosen Pengampu*)	1. Dwi Sunaryono 2. Abdul Munif 3. Adhatus Solichah Ahmadiyah 4. Shintami Chusnul Hidayati 5. Ratih Nur Esti Anggraini 6. Kelly Rossa Sungkono
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Database System (*Sistem Basis Data*)
Course Description (*Deskripsi Mata Kuliah*)	Students will learn about modeling complex systems in industry based on business processes. According to the reference model, students will implement and manage an optimal SQL database. Lectures are presented in the classroom and students will work on small project as a practice. The aim of this course is to provide experience to students about managing and handling problems when working on large-scale data. This course will cover distributed database and data warehouse as well.

	Pada mata kuliah ini, mahasiswa akan mempelajari tentang pemodelan sistem kompleks di bidang industri sesuai dengan business rule yang diterapkan pada studi kasus. Dari pemodelan yang telah dibuat sebelumnya, mahasiswa akan menerapkan SQL Programming dan melakukan administrasi database untuk mendapatkan performa yang optimal. Dengan penyampaian materi dalam bentuk perkuliahan di kelas dan praktik proyek kecil, diharapkan mahasiswa memiliki pengalaman dalam mengelola dan menangani permasalahan yang sering muncul pada data berskala besar. Dalam kuliah ini, akan disampaikan juga pengetahuan lanjut mengenai basis data terdistribusi dan data warehouse.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to model databases in various industrial fields 2. Students are able to model an active database that is integrated with business rules 3. Students are able to handle large-scale data problems *1. Mahasiswa mampu memodelkan basis data di berbagai bidang industri* *2. Mahasiswa mampu memodelkan basis data aktif yang terintegrasi dengan business rules* *3. Mahasiswa mampu menangani permasalahan data berskala besar*
Content (*Materi Pembelajaran*)	1. Databases and Data Modeling 2. Query 3. Object Database and Change Management 4. Active Database and Triggers 5. Indexing 6. Query Optimization and Manipulation 7. Database Administrator 8. Database Tuning *1. Basis Data dan Data Modelling* *2. Query* *3. Object Database dan Change Management*

	4. Active Database dan Trigger *5. Pengindekan (indexing)* *6. Optimasi dan Manipulasi Query* *7. Database Administrator* *8. Database Tuning*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Ramakrishnan, Raghu, Gehrke, Johannes. "Database Management Systems", 3th ed., New York: The McGraw-Hill Companies Inc., 2003 Supporting: 1. Avi Silberschatz, "Database System Concepts", 5th edition, 2002. 2. Morgan Kaufman, "Advanced Database System", Morgan Kaufman Publisher Inc., 1993. 3. Howe, David, "Data Analysis for Database Design", 3th edition. Butterworth-Heineman, 2001.

Algorithm Design and Analysis

Course (*Mata Kuliah*)	**Algorithm Design and Analysis (*Perancangan dan Analisis Algoritma*)**
Code (*Kode Mata Kuliah*)	EF234405
Semester	4
Lecturer (*Dosen Pengampu*)	1. Rully Soelaiman 2. Misbakhul Munir Irfan Subakti 3. Agus Budi Raharjo
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Data Structure (*Struktur Data*) Discrete Mathematics (*Matematika Diskrit*)
Course Description (*Deskripsi Mata Kuliah*)	The material in this course teaches students to master the principles of making an algorithm and various concepts of programming languages. So that students are able to design and analyze algorithms to solve problems effectively and efficiently based on strong programming rules, and are able to apply programming models that underlie various existing programming languages, and are able to choose programming languages to produce appropriate applications.

	Materi dalam MK PAA mengajarkan mahasiswa untuk menguasai prinsip-prinsip pembuatan suatu algoritma dan berbagai macam konsep bahasa pemrograman. Sehingga mahasiswa mampu merancang dan menganalisa algoritma untuk menyelesaikan permasalahan secara efektif dan efisien berdasarkan kaidah-kaidah pemrograman yang kuat, serta mampu mengaplikasikan model-model pemrograman yang mendasari berbagai bahasa pemgrogram yang ada, serta mampu memilih bahasa pemrograman untuk menghasilkan aplikasi yang sesuai.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Course participants can model computational problems algorithmically. 2. Course participants can apply the optimal algorithm design to a particular computational problem model 3. Course participants are able to analyze algorithm designs which include aspects of correctness and complexity. 4. Course participants are able to implement algorithm designs involving efficient data structures using object-oriented programming language. *1. Peserta mata kuliah dapat memodelkan persoalan komputasi secara algoritmik* *2. Peserta mata kuliah dapat menerapkan rancangan algoritma yang optimal terhadap suatu model persoalan komputasi tertentu* *3. Peserta mata kuliah mampu menganalisis rancangan algoritma yang meliputi aspek kebenaran dan kompleksitas* *4. Peserta mata kuliah mampu mengimplementasikan rancangan algoritma dengan melibatkan struktur data yang efisien dengan menggunakan bahasa pemrograman berorientasi obyek*
Content (*Materi Pembelajaran*)	1. AL/Basic Analysis 2. AL/Algorithmic Strategies

	3. AL/Fundamental Data Structures and Algorithms 4. AL/Advanced Computational Complexity 5. AL/Advanced Data Structures, Algorithms, and Analysis 1. *AL/Analisis Dasar* 2. *AL/Strategi Algoritmik* 3. *AL/Struktur dan Algoritma Data Dasar* 4. *AL/Kompleksitas Komputasi Tingkat Lanjut* 5. *AL/Struktur Data, Algoritma, dan Analisis Tingkat Lanjut*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms, 3rd Edition", MIT Press, 2009 Supporting: 1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms, 3rd Edition", Addison-Wesley, 2011 2. Steven Halim, Felix Halim, Suhendry Effendy, "Competitive Programming 4, The Lower Bound of Programming Contests in the 2020s", 2020

Machine Learning

Course (*Mata Kuliah*)	**Machine Learning (*Pembelajaran Mesin*)**
Code (*Kode Mata Kuliah*)	EF234406
Semester	4
Lecturer (*Dosen Pengampu*)	1. Nanik Suciati 2. Chastine Fatichah 3. Anny Yuniarti 4. Dini Adni Navastara 5. Shintami Chusnul Hidayati 6. Darlis Herumurti
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Artificial Intelligence Concepts (*Konsep Kecerdasan Artifisial*)
Course Description (*Deskripsi Mata Kuliah*)	In this course, students learn about various machine learning techniques. Through theoretical discussions in class and the application of case studies in the form of project assignments, students will have the experience to create intelligent applications using supervised learning with classification methods (k-NN, Naïve Bayes, Decision Tree, SVM, Artificial Neural Network) and unsupervised learning with clustering methods (K-Means, Hierarchical Clustering). Project

	assignments can be done either individually or in groups. *Pada mata kuliah ini mahasiswa belajar tentang berbagai teknik pembelajaran mesin. Melalui pembahasan teoritis di kelas serta penerapan studi kasus dalam bentuk tugas proyek, mahasiswa akan memiliki pengalaman untuk membuat aplikasi cerdas menggunakan pembelajaran terawasi dengan metode klasifikasi (k-NN, Naïve Bayes, Decision Tree, SVM, Jaringan Syaraf Tiruan) dan pembelajaran tidak terawasi dengan metode clustering (K-Means, Hierarchical Clustering). Tugas proyek dapat dikerjakan baik secara individu maupun berkelompok.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the concept of machine learning and its application in various types of applications. 2. Students are able to explain clustering methods and their evaluation, as well as their use in an application. 3. Students are able to explain distance, probability and rule-based classification methods, and their use in an application. 4. Students are able to explain discriminant function-based classification methods (linear and non-linear) and their evaluation, as well as their use in an application. 5. Students are able to explain the concept of Reinforcement Learning and its use in an application. 6. Students are able to create clustering and classification programs, and analyze their performance. 1. *Mahasiswa mampu menjelaskan konsep pembelajaran mesin dan penerapannya pada berbagai tipe aplikasi.*

	2. *Mahasiswa mampu menjelaskan metode clustering dan evaluasinya, serta penggunaannya dalam suatu aplikasi.* 3. *Mahasiswa mampu menjelaskan metode klasifikasi berbasis jarak, probabilitas dan aturan, serta penggunaannya pada suatu aplikasi.* 4. *Mahasiswa mampu menjelaskan metode klasifikasi berbasis fungsi diskriminan (linear dan non-linear) dan evaluasinya, serta penggunaannya dalam suatu aplikasi.* 5. *Mahasiswa mampu menjelaskan konsep Reinforcement Learning dan penggunaannya pada suatu aplikasi.* 6. *Mahasiswa mampu membuat program clustering dan klasifikasi, serta menganalisis kinerjanya.*
Content (*Materi Pembelajaran*)	1. IS/Basic Machine Learning 2. IS/Reasoning Under Uncertainty 3. IS/Advanced Machine Learning 1. *IS/Pembelajaran Mesin Dasar* 2. *IS/Penalaran di Bawah Ketidakpastian* 3. *IS/Pembelajaran Mesin Tingkat Lanjut*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Stuart Russel, Peter Norvig, Artificial Intelligence: A Modern Approach, Fourth edition, Pearson, 2020 2. Christopher Bishop, Pattern Recognition and Machine Learning. Springer, 2006

	3. Andries P. Engelbrecht, Computational Intelligence An Introduction, Second Edition, John Wiley & Sons Ltd, 2007 4. Rudolf Kruse, Christian Borgelt, Frank Klawonn, Christian Moewes, Matthias Steinbrecher, Pascal Held, Computational Intelligence: A Methodological Introduction, Springer, 2013 Supporting: 1. Michael Negnevitsky, Artificial Intelligence: A Guide to Intelligent Systems, Second Edition, Addison Wesley, 2002 2. Arthur K. Kordon, Applying Computational Intelligence, Springer-Verlag Berlin Heidelberg 2010 3. S. Sumathi, Surekha P., Computational Intelligence Paradigms: Theory and Applications using MATLAB, CRC Press, 2010 4. Peter Harrington, Machine Learning in Action, Manning, 2012

Software Design

Course (*Mata Kuliah*)	**Software Design (*Perancangan Perangkat Lunak*)**
Code (*Kode Mata Kuliah*)	ER234301
Semester	4
Lecturer (*Dosen Pengampu*)	1. Nanik Suciati 2. Chastine Fatichah 3. Anny Yuniarti 4. Dini Adni Navastara 5. Shintami Chusnul Hidayati 6. Darlis Herumurti
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Object Oriented Programming (*Pemrograman Berorientasi Obyek*)
Course Description (*Deskripsi Mata Kuliah*)	The Software Design course contains concepts and principles in software design and development, software design issues, software types, software design approaches, software architecture concepts, software design patterns, data design, framework reuse, and interface design. After completing this course, students can produce software design products that meet various quality parameters both technically and managerially, and are effective.

	Students can complete assignments independently and in groups. *Mata kuliah Perancangan Perangkat Lunak berisi konsep dan prinsip-prinsip dalam perancangan dan pembangunan perangkat lunak, isu perancangan perangkat lunak, tipe-tipe perangkat lunak, pendekatan perancangan perangkat lunak, konsep arsitektur perangkat lunak, pola-pola perancangan perangkat lunak, perancangan data, penggunaan kembali kerangka kerja, dan perancangan antarmuka. Setelah menyelesaikan mata kuliah ini, mahasiswa dapat menghasilkan produk rancangan perangkat lunak yang memenuhi berbagai parameter kualitas baik secara teknis maupun manajerial, dan berdaya guna. Mahasiswa dapat menyelesaikan tugas secara mandiri dan kelompok.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1.
Content (*Materi Pembelajaran*)	1. Principles of Software Design 2. Key Software Design Issues 3. Types of Software 4. Software Design Approach 5. Software Architecture Concepts 6. Design Patterns 7. Framework Reuse 8. Interface Design 1. *Prinsip-prinsip Perancangan Perangkat Lunak* 2. *Isu-isu Kunci Perancangan Perangkat Lunak* 3. *Tipe-tipe Perangkat Lunak* 4. *Pendekatan Perancangan Perangkat Lunak* 5. *Konsep-konsep Arsitektur Perangkat Lunak* 6. *Pola-pola Perancangan* 7. *Penggunaan Kembali Kerangka Kerja* 8. *Perancangan Antarmuka*

Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. D. Budgen, Software Design, 2nd ed., Addison-Wesley, 2003. Supporting: 1. Hong Zhu, Software Design Methodology: From Principles to Architectural Styles, Elsevier, 2005. 2. Eddie E. Burris, Programming in the Large with Design Patterns, Pretty Print Press, 2012. 3. Sommerville, Software Engineering, 9th ed., Addison-Wesley, 2011. 4. E. Gamma et al., Design Patterns: Elements of Reusable Object-Oriented Software, 1st ed, Addison-Wesley Professional, 1994. 5. Pfleeger, S., Software Engineering Theory and Practice, Prentice Hall, 2001. 6. Eric Freeman, Elisabeth Freeman, A Brain-Friendly Guide: Head First Design Patterns, O'Reilly Media Inc., 2004. 7. P.Clements et al., Documenting Software Architectures: Views and Beyond, 2nd ed., Pearson Education, 2010.

Semester 5

Framework Based Programming (Pemrograman Berbasis Kerangka Kerja)

Course (*Mata Kuliah*)	**Framework Based Programming (Pemrograman Berbasis Kerangka Kerja)**
Code (*Kode Mata Kuliah*)	EF234501
Semester	5
Lecturer (*Dosen Pengampu*)	Fajar Baskoro Dwi Sunaryono Irfan Subakti
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This course introduces programming concepts using framework technology for students who already have knowledge of structured programming, object programming, and web programming. Topics include the principles of framework technology and their use to create applications. *Mata kuliah ini memperkenalkan konsep pemrograman menggunakan teknologi framework untuk mahasiswa yang telah memiliki pengetahuan pemrograman terstruktur, pemrograman obyek, dan pemrograman web. Topik-topik mencakup prinsip-prinsip teknologi framework dan penggunaanya untuk membuat aplikasi.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. *Students are able to explain the concept of framework programming.*

	2. *Students are able to analyze problems using a framework approach.* 3. *Students are able to model problem solutions using a programming framework approach.* 4. *Students are able to implement problem solutions in the form of applications using framework technology.* 1. *Mahasiswa mampu menjelaskan konsep pemrograman framework.* 2. *Mahasiswa mampu menganalisis permasalahan menggunakan pendekatan framework.* 3. *Mahasiswa mampu memodelkan solusi permasalahan menggunakan pendekatan framework programming.* 4. *Mahasiswa mampu mengimplementasikan solusi permasalahan dalam bentuk aplikasi menggunakan teknologi framework.*
Content (*Materi Pembelajaran*)	• Introduction to programming frameworks • Create simple applications with desktop frameworks • Create simple programming with CRUD and framework libraries • Get to know MVC Techniques • Create Application View • Create Models • Model View integration with Controller • NET Framework • WPF - Windows Presentation Foundation • NET - Desktop Applications • Code Igniter Framework • Online Store with CI • Laravel Framework • CRUD with Laravel 1 • Records Management Case Study • Evaluation - Final Project • Pengenalan Pemrograman framework • Membuat aplikasi sederhana dengan framework desktop • Membuat pemrograman sederhana dengan CRUD dan library framework • Mengenal Teknik MVC • Membuat View Aplikasi • Membuat Model • Integrasi Model View dengan Controller • NET Framework • WPF - Windows Presentation Foundation • NET - Desktop Application

	• Framework Code Igniter • Toko Online dengan CI • Framework Laravel • CRUD dengan Laravel 1 • Studi Kasus Manajemen Arsip • Evaluasi - Final Project
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. "Windows Communication Foundation 4 Step by Step" by John Sharp 2. "Pro ASP.NET Core MVC" by Adam Freeman 3. "Laravel: Up & Running" by Matt 4. "CodeIgniter : Getting Started" by David Upton Supporting: 1. "PHP Objects, Patterns, and Practice" by Matt Zandstra 2. "PHP Web Services: APIs for the Modern Web" by Lorna Jane Mitchell 3. "Programming Windows with C#" by Charles Petzold 4. "Pro ASP.NET Core MVC" by Adam Freeman

Computer Graphics (Grafika Komputer)

Course (*Mata Kuliah*)	**Computer Graphics (Grafika Komputer)**
Code (*Kode Mata Kuliah*)	EF234504
Semester	5
Lecturer (*Dosen Pengampu*)	Dr. Anny Yuniarti, S.Kom., M.Comp.Sc Dr. Eng Darlis Herumurti, S.Kom, M.Kom Hadziq Fabroyir, S.Kom., Ph.D. Siska Arifiani, S.Kom., M.Kom
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Computer graphics courses study several types of methods that can be used to manipulate data to be visualized on computer output devices such as monitors. In this course several graphic libraries are used such as HTML Canvas Graphics, WebGL, three.js, and others in developing web-based computer graphics applications. *Mata kuliah grafika komputer mempelajari beberapa jenis metode yang dapat digunakan untuk memanipulasi data untuk divisualisasikan pada perangkat output komputer seperti monitor. Pada mata kuliah ini digunakan beberapa pustaka grafika (graphics library) seperti HTML Canvas Graphics, WebGL, three.js, dan lain-lain dalam mengembangkan aplikasi grafika komputer berbasis web.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the basics of graphics systems and graphics pipelines in graphics libraries. 2. Students are able to understand linear algebra theory for computer graphics. 3. Students are able to develop and demonstrate simple graphics programs using graphics libraries such as WebGL, three.js, and so on. 4. Students are able to develop and demonstrate computer graphics applications in team collaboration using graphics libraries such as WebGL, three.js, and so on. 1. *Mahasiswa mampu menjelaskan dasar-dasar sistem grafika dan graphics pipeline dalam pustaka grafika.* 2. *Mahasiswa mampu memahami teori aljabar linear untuk grafika komputer.* 3. *Mahasiswa mampu mengembangkan dan mendemonstrasikan program grafik sederhana dengan menggunakan pustaka grafika (graphics library) seperti WebGL, three.js, dan sebagainya.* 4. *Mahasiswa mampu mengembangkan dan mendemonstrasikan aplikasi grafika komputer secara kerjasama tim dengan menggunakan pustaka grafika (graphics library) seperti WebGL, three.js, dan sebagainya.*
Content (*Materi Pembelajaran*)	• Graphics System, 3D Graphics Elements • 2D Graphics: Pixel, Coordinate System, Colors, Shapes, 2D Transformation • Grafika 2D: Pemodelan Hierarkis, HTML Canvas Graphics • WebGL/Three.js: Programmable pipeline, GLSL • WebGL/Three.js: Image textures, Transformasi 2D • Grafika 3D dengan WebGL/Three.js: Transformasi 3D, Lighting, Material • Grafika 3D dengan WebGL/Three.js: Textures, Framebuffers, WebGL Extensions • Dasar pemrograman grafika berbasis game engine seperti Unity3D • Lighting dan rendering di game engine seperti Unity3D • Sistem kamera di game engine seperti Unity3D

	• Pemodelan objek di game engine seperti Unity3D • Elemen Interaksi di game engine seperti Unity3D • Shading language (HLSL) di game engine seperti Unity3D • *Sistem Grafika, Elemen-elemen Grafika 3D* • *Grafika 2D: Piksel, Sistem Koordinat, Warna, Bentuk, Transformasi 2D* • *Grafika 2D: Pemodelan Hierarkis, HTML Canvas Graphics* • *WebGL/Three.js: Programmable pipeline, GLSL* • *WebGL/Three.js: Image textures, Transformasi 2D* • *Grafika 3D dengan WebGL/Three.js: Transformasi 3D, Lighting, Material* • *Grafika 3D dengan WebGL/Three.js: Textures, Framebuffers, WebGL Extensions* • *Dasar pemrograman grafika berbasis game engine seperti Unity3D* • *Lighting dan rendering di game engine seperti Unity3D* • *Sistem kamera di game engine seperti Unity3D* • *Pemodelan objek di game engine seperti Unity3D* • *Elemen Interaksi di game engine seperti Unity3D* • *Shading language (HLSL) di game engine seperti Unity3D*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Edward Angel, Dave Shreiner - Interactive Computer Graphics. A Top-Down Approach with WebGL (2014, Pearson)

	2. Farhad Ghayour, Diego Cantor - Real-Time 3D Graphics with WebGL 2_ Build interactive 3D applications with JavaScript and WebGL 2 (OpenGL ES 3.0), 2nd Edition (2018) Supporting: 1. Jos Dirksen - Learning Three.js _ Programming 3D Animations and Visualizations for The Web with HTML5 and WebGL (2018) 2. Jos Dirksen - Learning Three.js_ The JavaScript 3D Library for WebGL (2015) 3. Kouichi Matsuda, Rodger Lea - WebGL Programming Guide_ Interactive 3D Graphics Programming with WebGL (2013) 4. Tony Parisi - Programming 3D Applications with HTML5 and WebGL (2014, O'Reilly Media)

Operation Research (Riset Operasi)

Course (*Mata Kuliah*)	**Operation Research (*Riset Operasi*)**
Code (*Kode Mata Kuliah*)	EF234510
Semester	5
Lecturer (*Dosen Pengampu*)	Dr. Bilqis Amaliah, S.Kom., M.Kom. Arya Yudhi Wijaya, S.Kom, M.Kom. Victor Hariadi, S.Si., M.Kom. Dr. Ahmad Saikhu, S.Si., MT. Prof. Dr. Ir. Joko Lianto Buliali, M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Operations Research is designed so that students are able to understand and explain linear programming models, transportation problems, shortest route problems, project control. *Riset Operasi dirancang agar mahasiswa mampu memahami dan menjelaskan Model Program linier, persolan transportasi, persolan rute terpendek, pengendalian proyek.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and explain linear programming models. 2. Students are able to design and solve transportation problems. 3. Students are able to design and solve shortest route problems. 4. Students are able to design and analyze project controls.

	1. *Mahasiswa mampu memahami dan menjelaskan Model Program linier.* 2. *Mahasiswa mampu merancang dan menyelesaikan persolan transportasi.* 3. *Mahasiswa mampu merancang dan menyelesaikan persolan rute terpendek.* 4. *Mahasiswa mampu merancang dan menganalisa pengendalian proyek.*
Content (*Materi Pembelajaran*)	• Introduction to Operations Research and Linear Program Modeling • Linear programs can be solved using the Simplex method, M and 2 phase techniques, and integer linear programming • Initial resolution of transportation problems using the NWM, LCM and VAM methods • Final solution to transportation problems using the stepping stone method • Special forms of transportation problems can be solved using assignment models • The shortest route method problem can be solved using the Diskjtra, Floyd, and maximum flow methods • Design and analyze project controls • *Pengenalan Riset Operasi dan Pemodelan Program Linier* • *Program Linier dapat diselesaikan dengan menggunakan metode Simplex, Teknik M dan 2 fase, dan integer linier programming* • *Penyelesaian awal persoalan transportasi dengan menggunakan metoda NWM, LCM dan VAM* • *Penyelesaian akhir persoalan transportasi dengan menggunakan metoda stepping stone* • *Bentuk khusus dari persoalan transportasi dapat diselesaikan dengan model penugasan* • *Persoalan metode rute terpendek dapat diselesaikan dengan menggunakan metode Diskjtra, Floyd, dan model maximum flow* • *Merancang dan menganalisa pengendalian proyek*

Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Operations Research an Introduction; Hamdy A. Taha, University of Arkansas, Fayetteville, Pearson, Tenth edition, 2017. Supporting: -

Game Development Techniques (Teknik Pengembangan Game)

Course (*Mata Kuliah*)	**Game Development Techniques (*Teknik Pengembangan Game*)**
Code (*Kode Mata Kuliah*)	EF234511
Semester	5
Lecturer (*Dosen Pengampu*)	Imam Kuswardayan, S.Kom., M.T.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The Game Development Techniques course is designed to provide knowledge, understanding, and application of the game development process which includes requirements analysis (theory of fun), mechanical design, scenarios, level of difficulty with documentation, and implementation with a game engine. Students are expected to be able to identify the fun factors contained in a game, design to increase the level of fun and implement it in a game. *Mata kuliah Teknik Pengembangan Game dirancang untuk memberikan pengetahuan, pemahaman, dan penerapan tentang proses pengembangan game yang meliputi analisa kebutuhan (theory of fun), perancangan mekanik, skenario, tingkat kesulitan dengan dokumentasinya, hingga diimplementasikan dengan game engine. Mahasiswa diharapkan mampu mengidentifikasi faktor-faktor kesenangan apa saja yang terdapat di dalam sebuah game, merancang untuk*

	meningkatkan tingkat kesenangan hingga menerapkan dalam sebuah game.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students understand the definition of games, their classification and technological developments. 2. Students are able to understand the game development process which includes requirements analysis, game mechanic design, difficulty level design, supporting technology, implementation, testing, and documentation. 3. Students are able to understand, analyze and design fun factors in a game application. 4. Students know various technologies and frameworks supporting game development. 5. Students are able to build simple game applications with or without the help of a game engine. *1. Mahasiswa memahami tentang definisi game, klasifikasi dan perkembangan teknologinya.* *2. Mahasiswa mampu memahami proses pengembangan game yang meliputi analisa kebutuhan, perancangan mekanik game, perancangan tingkat kesulitan, teknologi pendukung, implementasi, pengujian, dan pendokumentasiannya.* *3. Mahasiswa mampu memahami, menganalisa, dan merancang faktor-faktor kesenangan (fun) pada sebuah aplikasi game.* *4. Mahasiswa mengetahui berbagai macam teknologi dan kerangka kerja pendukung pengembangan game.* *5. Mahasiswa mampu membangun aplikasi game sederhana dengan atau tanpa bantuan game engine.*
Content (*Materi Pembelajaran*)	• Definition and classification of Games • Theory of fun • Game Mechanics • Level Design • Game Design Document • Game Engine/Middleware • *Definisi dan klasifikasi Game*

	• *Teori Kesenangan* • *Mekanik Game* • *Desain Level* • *Game Design Document* • *Game Engine / Middleware*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Arnest Adams, "Fundamentals of Game Design", New Riders Press, 2nd Edition 2010. Supporting: 1. Theory of Fun for Game Design, Ralph Koster, 2nd Edition Nov 2013. 2. Arnest Adams, Joris Dormans, "Game Mechanics, Advanced Game Design", New Rider Press, 2012.

Requirement Engineering

Course (*Mata Kuliah*)	**Requirement Engineering (*Rekayasa Kebutuhan*)**
Code (*Kode Mata Kuliah*)	ER234201
Semester	5
Lecturer (*Dosen Pengampu*)	• Adhatus Solichah Ahmadiyah, S.Kom, M.Sc. • Prof. Daniel O. Siahaan, S.Kom. M,Sc, PD.Eng. • Fajar Baskoro, S.Kom., M.T • Ratih Nur Esti Anggraini, S.Kom., M.Sc., Ph.D.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The Requirement Engineering course is part of the Software Engineering family which discusses elicitation, analysis, specifications, and validation of software requirements, as well as requirements management during the life cycle of software products. Researchers and industry practitioners have recognized that a software development project is very vulnerable to failure when activities related to software requirements are carried out poorly. The Requirement Engineering course is important for students to master because it is one of the determining factors for the success of a software development project *Mata Kuliah Rekayasa Kebutuhan merupakan bagian dari rumpun Rekayasa Perangkat Lunak yang membahas tentang elisitasi, analisis, spesifikasi, dan validasi kebutuhan perangkat lunak, serta manajemen*

	kebutuhan selama daur hidup produk perangkat lunak. Peneliti dan praktisi industri sudah mengakui bahwa suatu proyek pengembangan software sangat rentan terhadap kegagalan ketika aktivitas-aktivitas terkait kebutuhan perangkat lunak dilaksanakan secara kurang baik. Mata kuliah Rekayasa kebutuhan menjadi penting dikuasai oleh mahasiswa karena merupakan salah satu faktor penentu keberhasilan suksesnya suatu proyek pengembangan perangkat lunak
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the basics of software requirements engineering 2. Students are able to apply requirement elicitation techniques in a software development project 3. Students are able to model software needs using a standard modeling language 4. Students are able to document software requirements specifications formally based on a particular software development approach *5.* Students are able to manage software needs based on a specific software development approach *1. Mahasiswa mampu menjelaskan dasar-dasar rekayasa kebutuhan perangkat lunak* *2. Mahasiswa mampu menerapkan teknik elisitasi kebutuhan dalam suatu proyek pengembangan perangkat lunak* *3. Mahasiswa mampu memodelkan kebutuhan perangkat lunak menggunakan bahasa pemodelan yang baku* *4. Mahasiswa mampu mendokumentasikan spesifikasi kebutuhan perangkat lunak secara formal berdasarkan pada pendekatan pengembangan perangkat lunak tertentu* *5. Mahasiswa mampu mengelola kebutuhan perangkat lunak berdasarkan pada pendekatan pengembangan perangkat lunak tertentu*
Content (*Materi Pembelajaran*)	• Software Requirement Engineering Fundamentals • The Role of Requirement Engineering in Software Development • Principles in Requirement Engineering • Business Analytics in Requirement Engineering

	• Requirement Engineering Processes • Elicitation of Requirement • Problems in Elicitation of Requirement • Source of Necessity • Elicitation Techniques • Requirement Analysis • Requirement Model • Classification of Requirement • Conflict and Prioritization of Requirement • Requirement Specifications • Formalization of Requirement • SMART • Validation Requirement • Validation and Verification • Needs Testing • Needs Management • Needs Tracking • Change Requirement Management • Reuse Requirement • Auxiliary Tools in Requirement Engineering • *Dasar-dasar Rekayasa Kebutuhan Perangkat Lunak* • *Peran Rekayasa Kebutuhan dalam Pengembangan Perangkat Lunak* • *Prinsip-Prinsip dalam Rekayasa Kebutuhan* • *Analisis Bisnis dalam Rekayasa Kebutuhan* • *Proses-Proses Rekayasa Kebutuhan* • *Elisitasi Kebutuhan* • *Permasalahan dalam Elisitasi Kebutuhan* • *Sumber Kebutuhan* • *Teknik-Teknik Elisitasi* • *Analisis Kebutuhan* • *Model Kebutuhan* • *Klasifikasi Kebutuhan* • *Konflik dan Prioritasi Kebutuhan* • *Spesifikasi Kebutuhan* • *Formalisasi Kebutuhan* • *SMART* • *Validasi Kebutuhan*

	• *Validasi dan Verifikasi* • *Pengujian Kebutuhan* • *Manajemen Kebutuhan* • *Pelacakan Kebutuhan* • *Manajemen Perubahan Kebutuhan* • *Penggunaan Ulang Kebutuhan* • *Kakas Bantu dalam Rekayasa Kebutuhan*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Daniel Siahaan, Analisis Kebutuhan dalam Rekayasa Perangkat Lunak, Penerbit Andi, 2011. 2. Karl Wiegers and Candase Hokanson, Software Requirements Essentials: Core Practices for Successful Business Analysis, Addison-Wesley Professional, 2023 3. Karl E Wiegers and Joy Beatty, Software Requirements, 3rd Edition, Microsoft, 2012. 4. Ian K. Bray, An Introduction to Requirements Engineering, Addison Wesley, 2002. 5. Pressman, R. S., Software Engineering: A Practitioner's Approach, 8th Edition, McGraw-Hill, 2008 Supporting (*Pendukung*): 1. IEEE Computer Society, SWEBOK v.3.0, IEEE, 2014 2. Annual Conference: International Requirements Engineering Conference, IEEE

Image and Vision Processing Computer

Course (*Mata Kuliah*)	**Image and Vision Processing Computer (*Pengolahan Citra dan Visi Komputer*)**
Code (*Kode Mata Kuliah*)	EF234517
Semester	5
Lecturer (*Dosen Pengampu*)	• Prof.Ir. Handayani Tjandrasa, M.Sc Ph.D
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Machine Learning (*Pembelajaran Mesin)*
Course Description (*Deskripsi Mata Kuliah*)	The Image Processing and Computer Vision course is designed to provide students with knowledge of spatial repair and filter techniques, discrete Fourier transformations and filters in the frequency domain. Furthermore, students will learn segmentation processes, Hough transformations, morphological methods, feature extraction methods for image descriptors, and be able to design image recognition systems using machine learning. Students learn and are able to apply deep learning methods in computer vision to image recognition systems, object detection, object tracing or action recognition, and semantic segmentation *Mata kuliah Pengolahan Citra dan Visi Komputer dirancang untuk memberikan pengetahuan kepada mahasiswa tentang teknik perbaikan dan filter spasial, transformasi diskrit Fourier dan filter dalam domain*

	frekuensi. Selanjutnya mahasiswa akan belajar proses segmentasi, transformasi Hough, metode morfologi, metode ekstraksi fitur untuk deskriptor citra, dan mampu merancang sistem pengenalan citra dengan menggunakan machine learning . Mahasiswa belajar dan mampu menerapkan metode deep learning dalam visi komputer untuk sistem pengenalan citra, deteksi objek, penelusuran objek atau pengenalan aksi, dan segmentasi semantik
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to apply image processing and computer vision to image repair with filters in the spatial and frequency domains. 2. Students are able to apply segmentation methods based on discontinuity and similarity, and are able to apply morphology methods. 3. Students are able to apply feature extraction methods to descriptors and design image recognition systems with machine learning. 4. Students are able to apply deep learning architecture for image recognition, object detection, object tracing or action recognition, and semantic segmentation. *5.* Students are able to analyze and develop applications in the field of image processing and computer vision. *1. Mahasiswa mampu menerapkan pengolahan citra dan visi komputer untuk perbaikan citra dengan filter dalam domain spasial dan frekuensi.* *2. Mahasiswa mampu menerapkan metode segmentasi berbasis diskontinuitas dan similaritas, dan mampu menerapkan metode morphology.* *3. Mahasiswa mampu menerapkan metode ekstraksi fitur untuk deskriptor dan merancang sistem pengenalan citra dengan machine learning.* *4. Mahasiswa mampu menerapkan arsitektur deep learning untuk pengenalan citra, deteksi objek, penelusuran objek atau pengenalan aksi, dan segmentasi semantik.*

	5. *Mahasiswa mampu menganalisis dan mengembangkan aplikasi di bidang pengolahan citra dan visi komputer.*
Content (*Materi Pembelajaran*)	• Introduction to Image Processing and Computer Vision: Concepts in image processing and computer vision, their use, and application examples. • Spatial enhancement using point processing: Various curve transformations. Histogram: Definition of histogram, histogram equalization, Contrast Limited Adaptive Histogram Equalization (CLAHE). Convolution: Low Pass Filter (smoothing/blurring), High Pass Filter sharpening). Median filter (non-linear filter). Color image improvement: Color basics, color image processing, and pseudo color. • Fourier transforms, DFT, FFT, frequency domain images. Frequency domain processing diagram. Image enhancement in the frequency domain using Low Pass Filter (LPF): Ideal LPF (ILPF), Butterworth LPF (BLPF), Gaussian LPF (GLPF). High Pass Filter (HPF): IHPF, BHPF, GHPF. • Discontinuity-based image segmentation: Point detection, line detection, Gradient filter, Laplacian filter, Laplacian of Gaussian (LoG), Gaussian & Laplacian result examples. Splicing edges with gradient criteria. Hough transform for line and circle detection. • Similarity-based image segmentation: Global thresholding, Otsu method, optimal and adaptive thresholding, histogram of gradient. Region Growing. Segmentation of areas by clustering, watershed, examples. • Morphology methods: Examples of binary imagery, connectivity, additive and subtractive operators. The set of translations, reflections, structuring elements B for generalized operations. Dilasi, erosion, Opening operator, Closing operator, template matching. Matching with Hit-or-Miss, Hit-or-Miss operators, boundary extraction, thinning. • Deskriptor: Region descriptor, moment descriptor, texture, spectral texture, moment invariants,

	principle components, co-occurrence matrix, local binary pattern (LBP). Pengenalan objek dan klasifikasi citra dengan machine learning, contoh-contoh. • Image classification with convolutional neural networks (CNNs), examples. • Object detection with deep learning: Faster R-CNN, YOLO, and SSD. • Semantic segmentation with deep learning. • *Pengantar Pengolahan Citra dan Visi Komputer: Konsep pada pengolahan citra dan visi computer, penggunaan, serta contoh aplikasinya.* • *Enhancement spasial menggunakan point processing: Macam-macam transformasi kurva. Histogram: Definisi histogram, histogram equalization, Contrast Limited Adaptive Histogram Equalization (CLAHE). Konvolusi: Low Pass Filter (penghalusan/pengkaburan), High Pass Filter penajaman). Filter Median (non-linear filter). Perbaikan citra berwarna: Dasar warna, pengolahan citra berwarna, dan pseudo color.* • *Transformasi Fourier, DFT, FFT, citra domain frekuensi. Diagram pemrosesan domain frekuensi. Enhancement citra dalam domain frekuensi menggunakan Low Pass Filter (LPF): Ideal LPF (ILPF), Butterworth LPF (BLPF), Gaussian LPF (GLPF). High Pass Filter (HPF): IHPF, BHPF, GHPF.* • *Segmentasi citra berbasis diskontinuitas: Deteksi titik, deteksi garis, filter Gradient, filter Laplacian, Laplacian of Gaussian (LoG), contoh hasil Gaussian & Laplacian. Penyambungan tepi dengan kriteria gradient. Transformasi Hough untuk deteksi garis dan lingkaran.* • *Segmentasi citra berbasis similaritas: Global thresholding, metode Otsu, optimal dan adaptive thresholding, histogram of gradient. Region Growing. Segmentasi daerah dengan clustering, Watershed, contoh-contoh.* • *Metode morphology: Contoh citra biner, konektivitas, operator aditif dan subtraktif.*

	Himpunan translasi, refleksi, elemen penstruktur B untuk operasi yang digeneralisasi. Dilasi, erosi, Opening operator, Closing operator, template matching. Pencocokan dengan Hit-or-Miss, Hit-or-Miss operator, boundary extraction, thinning. • *Deskriptor: Region descriptor, moment descriptor, texture, spectral texture, moment invariants, principle components, co-occurrence matrix, local binary pattern (LBP). Pengenalan objek dan klasifikasi citra dengan machine learning, contoh-contoh.* • *Klasifikasi citra dengan convolutional neural networks (CNN), contoh-contoh.* • *Deteksi objek dengan deep learning: Faster R-CNN, YOLO, dan SSD.* • *Segmentasi semantik dengan deep learning*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. R.C. Gonzalez and R.E. Woods, "Digital Image Processing", 4th ed., Pearson Education, Inc., 2018. 2. W.K. Pratt, "Digital Image Processing", 4th ed., John Wiley & Sons, Inc., 2007. 3. D. A. Forsyth and J. Ponce, "Computer Vision: A Modern Approach", 2nd ed., Pearson Education, Inc., 2012Supporting Supporting (*Pendukung*): 1. I. Goodfellow, Y. Bengio, and A. Courville, "Deep Learning", MIT Press, 2016. 2. LISA lab, University of Montreal, "Deep Learning Tutorial", 2015

Data Mining

Course (*Mata Kuliah*)	**Data Mining (*Penambangan Data*)**
Code (*Kode Mata Kuliah*)	EF234518
Semester	5
Lecturer (*Dosen Pengampu*)	• Prof. Dr. Eng. Chastine Fatichah, S.Kom., M.Kom. • Dini Adni Navastara, S.Kom, M.Sc
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Machine Learning (*Pembelajaran Mesin)*
Course Description (*Deskripsi Mata Kuliah*)	In this lecture, students will learn data mining techniques starting from the stages of data exploration, data preprocessing, clustering, association rule mining, and classification so that it becomes useful information to support decision making or solving a problem *Pada perkuliahan ini mahasiswa akan mempelajari teknik-teknik data mining mulai tahap eksplorasi data, praproses data, clustering, association rule mining, dan klasifikasi sehingga menjadi informasi yang bermanfaat untuk mendukung pengambilan keputusan atau penyelesaian suatu masalah*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the stages of data mining, data characteristics, data exploration, and data preprocessing and their application to a problem 2. Students are able to explain class imbalance problem handling techniques and ensemble

	classification methods and their use in classification problems 3. Students are able to explain association rule techniques, sequential pattern analysis, and their use in a problem 4. Students are able to explain the clustering method and its use in a problem *5.* Students are able to explain the concepts and techniques of anomaly detection and their use in anomaly data. *1. Mahasiswa mampu menjelaskan tahapan data mining, karakteristik data, eksplorasi data, dan praproses data serta penerapannya pada suatu permasalahan* *2. Mahasiswa mampu menjelaskan teknik penanganan class imbalance problem dan metode klasifikasi ensemble serta penggunaannya pada permasalahan klasifikasi* *3. Mahasiswa mampu menjelaskan teknik association rule, sequential pattern analysis, serta penggunaanya pada suatu permasalahan* *4. Mahasiswa mampu menjelaskan metode clustering dan penggunaannya pada suatu permasalahan* *5. Mahasiswa mampu menjelaskan konsep dan teknik deteksi anomali serta penggunaanya pada data anomali*
Content (*Materi Pembelajaran*)	• Exploratory data analysis (EDA) • Preprocessing • Classification • Imbalanced classes • Association rule & sequential pattern analysis • Clustering • Anomaly detection • *Analisis data eksplorasi (EDA)* • *Preprocessing* • *Klasifikasi* • *Kelas tidak seimbang*

	• *Aturan asosiasi dan analisis pola berurutan* • *Klusterisasi* • *Deteksi anomali*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Pang-Ning Tan; Michael Steinbach; Anuj Karpatne; Vipin Kumar, "Introduction to Data Mining 2nd edition", Addison-Wesley, 2019. 2. Han, Jiawei, Kamber, Micheline, "Data Mining : Cconcept and Techniques 3rd edition", Morgan Kauffman Pub, 2011. Supporting (*Pendukung*): 1. Rajaraman, Anand, "Mining of Massive Datasets", Stanford University, 2011.

Internetworking Technology

Course (*Mata Kuliah*)	**Internetworking Technology (*Teknologi Antar Jaringan*)**
Code (*Kode Mata Kuliah*)	EF234506
Semester	5
Lecturer (*Dosen Pengampu*)	Dr. Baskoro Adi Pratomo
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Network (*Jaringan Komputer*)
Course Description (*Deskripsi Mata Kuliah*)	This course studies various dynamic routing technologies (RIP, OSPF, EIGRP, and BGP), layer 2 switching technologies such as STP and VLAN, and Virtual Private Networks. *Kuliah ini mempelajari berbagai teknologi routing dinamis (RIP, OSPF, EIGRP, dan BGP), teknologi layer 2 switching seperti STP dan VLAN, serta Virtual Private Networks.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the concept and implement STP and VLAN. 2. Students are able to explain the concepts of IPv6, migration from IPv4, and its addressing methods and implement them in the real world.

	3. Students are able to understand and implement dynamic routing with RIP. 4. Students are able to understand and implement dynamic routing with OSPF. 5. Students are able to understand and implement dynamic routing with EIGRP. 6. Students are able to understand and implement dynamic routing with BGP and redistribution protocols. 7. Students are able to understand how VPN works and know the differences between networks that use VPN and not. *1. Mahasiswa mampu memahami konsep dan mengimplementasikan STP dan VLAN.* *2. Mahasiswa mampu menjelaskan konsep IPv6, migrasi dari IPv4, dan metode pengalamatannya serta mengimplementasikannya di dunia nyata.* *3. Mahasiswa mampu memahami dan mengimplementasikan routing dinamis dengan RIP.* *4. Mahasiswa mampu memahami dan mengimplementasikan routing dinamis dengan OSPF.* *5. Mahasiswa mampu memahami dan mengimplementasikan routing dinamis dengan EIGRP.* *6. Mahasiswa mampu memahami dan mengimplementasikan routing dinamis dengan BGP dan redistribusi protokol.* *7. Mahasiswa mampu memahami cara kerja VPN dan mengetahui perbedaan jaringan yang menggunakan VPN dan tidak.*
Content (*Materi Pembelajaran*)	1. Cisco IOS Introduction 2. STP and VLAN 3. IPv6 4. RIP 5. OSPF 6. EIGRP 7. BGP

	8. VPN *1. Pengenalan Cisco IOS* *2. STP dan VLAN* *3. IPv6* *4. RIP* *5. OSPF* *6. EIGRP* *7. BGP* *8. VPN*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. CCNA Certification Study Guide, Volume 2: Exam 200-301, Todd Lammle 2. CCIE Routing and Switching Certification Guide, Denise Donohue 3. Network Routing: Algorithms, Protocols, and Architectures, 2nd Edition, Deepankar Medhi & Karthik Ramasamy

Wireless Networking

Course (*Mata Kuliah*)	**Wireless Networking (*Jaringan Nirkabel*)**
Code (*Kode Mata Kuliah*)	EF234507
Semester	5
Lecturer (*Dosen Pengampu*)	Radityo Anggoro
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Network (*Jaringan Komputer*)
Course Description (*Deskripsi Mata Kuliah*)	The Wireless Network course provides students with knowledge about the problems that exist in wireless networks and their characteristics. Then students are asked to design concepts or methods and implement them to solve problems such as data transmission, routing algorithms and MAC layers in wireless networks. *Kuliah Jaringan Nirkabel memberikan pengetahuan kepada mahasiswa tentang permasalahan yang ada pada jaringan nirkabel beserta karakteristiknya. Kemudian mahasiswa diminta merancang konsep atau metode dan mengimplementasikannya untuk menyelesaikan permasalahan – permasalahan*

	seperti pengiriman data, algortima routing dan MAC layer pada jaringan nirkabel.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and explain the concepts and principles of architecture, systems and the basics of wireless networks. 2. Students are able to understand and define the challenges that arise in wireless networks. 3. Students are able to understand and apply how communication methods work on wireless networks. 4. Students are able to understand and apply modification methods to improve data communication performance in wireless networks. 1. *Mahasiswa mampu memahami dan menjelaskan konsep dan prinsip arsitektur, sistem dan dasar - dasar jaringan nirkabel.* 2. *Mahasiswa mampu memahami dan mendefinisikan tantangan yang muncul pada jaringan nirkabel.* 3. *Mahasiswa mampu memahami dan menerapkan cara kerja metode komunikasi pada jaringan nirkabel.* 4. *Mahasiswa mampu memahami dan menerapkan metode modifikasi untuk meningkatkan performa komunikasi data di jaringan nirkabel.*
Content (*Materi Pembelajaran*)	1. AL/Strategi Algoritmik 2. AL/Struktur dan Algoritma Data Dasar 3. NC/Aplikasi Jaringan 4. NC/Pengiriman Data yang Andal 5. NC/Perutean dan Penerusan 6. NC/Jaringan Area Lokal 7. NC/Mobilitas 1. *AL/Algorithmic Strategies* 2. *AL/Fundamental Data Structures and Algorithms* 3. *NC/Networked Applications* 4. *NC/Reliable Data Delivery* 5. *NC/Routing And Forwarding*

	6. NC/Local Area Networks *7. NC/Mobility*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Pei Zheng, Larry L. Peterson, Bruce S. Davie, Adrian Farrel, Wireless Networking Complete, 2009, Morgan Kaufmann Supporting: 1. IEEE Transaction of Mobile Computing, IEEE 2. Pervasive and Mobile Computing, Elsevier

Enterprise Systems

Course (*Mata Kuliah*)	**Enterprise Systems (Sistem Enterprise)**
Code (*Kode Mata Kuliah*)	EF234513
Semester	5
Lecturer (*Dosen Pengampu*)	Kelly Rosa Sungkono
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, elective International undergraduate program, elective
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Enterprise systems study business processes and enterprise information systems. Students are expected to have competence in the analysis, synthesis, evaluation and innovation of enterprise systems according to the needs of business processes. *Sistem Enterprise mempelajari proses bisnis dan sistem informasi enterprise. Mahasiswa diharapkan memiliki kompetensi dalam analisis, sintesis, evaluasi dan inovasi sistem enterprise yang sesuai kebutuhan proses bisnis.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain business processes and information systems in an Enterprise System (ES) 2. Students are able to analyze, synthesize and evaluate Enterprise System (ES) business processes. 3. Students are able to analyze, synthesize and evaluate business process modeling. 4. Students are able to explain, analyze, synthesize and evaluate scalable and reconfigurable business processes of Enterprise System (ES)

	1. Mahasiswa mampu menjelaskan proses bisnis dan sistem informasi dalam Sistem Enterprise (SE) 2. Mahasiswa mampu menganalisis, mensintesis dan mengevaluasi proses bisnis Sistem Enterprise (SE) 3. Mahasiswa mampu menganalisis, mensintesis dan mengevaluasi pemodelan proses bisnis 4. Mahasiswa mampu menganalisis, mensintesis dan mengevaluasi pemodelan proses bisnis
Content (*Materi Pembelajaran*)	• Arsitektur Sistem Enterprise (Enterprise System Architecture) • Fungsional Sistem Enterprise (Enterprise System Functionality) • Proses Bisnis (Business Processes) • Workflow • Workflow management system (WMS) • Fleksibilitas Sistem Enterprise (Enterprise System Flexibility)
Study and examination requirements and forms of examination	1. Group reports 2. Midtest 3. Final exam *1. Laporan kelompok* *2. Evaluasi Tengah Semester* *3. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: - Simha R. Magal, Integrated Business Processes with ERP Systems, John Wiley & Sons, Inc., 2012 - Vivek Kale. Enterprise Process Management Systems : Engineering Process-Centric Enteprise Systems using BPMN 2.0, Taylor and Francis, 2019 - Manfred Reichert, Barbara We, Enabling Flexibility in Process-Aware Information Systems, Challenges, Methods, Technologies. Springer-Verlag, Berlin Heidelberg, 2012. Supporting: - Riyanarto Sarno, et al. (2013). Petri Net Model of ERP Business Process Variations for Small and Medium Enterprises, Journal of Theoretical

	and Applied Information Technology, 10th August 2013. Vol. 54 No.1, pp.31-38. - Papers about Workflow Management Systems (WMS).

IT Governance

Course (*Mata Kuliah*)	**IT Governance (*Tata Kelola Teknologi Informasi*)**
Code (*Kode Mata Kuliah*)	EF234514
Semester	5
Lecturer (*Dosen Pengampu*)	Adhatus Solichah Ahmadiyah
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, elective International undergraduate program, elective
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	In this course students will learn the importance of information technology governance, frameworks for information technology governance, implementation of information technology governance, maturity level calculations, gap analysis, and recommendations for information technology governance. *Pada mata kuliah ini mahasiswa akan mempelajari pentingnya tata kelola teknologi informasi, kerangka kerja dalam tata kelola teknologi informasi, penerapan tata kelola teknologi informasi, perhitungan tingkat kematangan, analisis kesenjangan, dan rekomendasi tata kelola teknologi informasi.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the importance of information technology governance 2. Students are able to explain the five domains of information technology governance 3. Students are able to explain several frameworks for information technology governance 4. Students are able to use tools to create business processes based on information technology governance framework guidelines

	5. Students are able to measure the maturity level of IT implementation using the information technology governance framework 6. Students are able to carry out gap analysis using the information technology governance framework 7. Students are able to provide recommendations for improving the implementation of information technology governance using the information technology governance framework *1. Mahasiswa mampu memahami pentingnya Tata kelola teknologi informasi* *2. Mahasiswa mampu menjelaskan lima domain Tata kelola teknologi informasi* *3. Mahasiswa mampu menjelaskan beberapa kerangka kerja untuk Tata kelola teknologi informasi* *4. Mahasiswa mampu menggunakan kakas bantu pembuatan proses bisnis berdasar panduan kerangka kerja Tata kelola teknologi informasi* *5. Mahasiswa mampu mengukur tingkat kematangan implementasi TI menggunakan kerangka kerja Tata kelola teknologi informasi* *6. Mahasiswa mampu melakukan analisis kesenjangan (gap analysis) menggunakan kerangka kerja Tata kelola teknologi informasi* 7. *Mahasiswa mampu memberikan rekomendasi perbaikan implementasi Tata kelola teknologi informasi menggunakan kerangka kerja Tata kelola teknologi informasi*
Content (*Materi Pembelajaran*)	• The importance of information technology governance • Five pillars of information technology governance • Information technology governance framework (COBIT, TOGAF) • Calculation of the maturity level of information technology governance • Analysis of gaps in the implementation of information technology governance • Providing recommendations for implementing information technology governance

	• *Pentingnya tata kelola teknologi informasi* • *Lima pilar tata kelola teknologi informasi* • *Kerangka kerja tata kelola teknologi informasi (COBIT, TOGAF)* • *Perhitungan tingkat kematangan tata kelola teknologi informasi* • *Analisis kesenjangan implementasi tata kelola teknologi informasi* • *Pemberian rekomendasi penerapan tata teknologi informasi*
Study and examination requirements and forms of examination	1. Assignments 2. Midtest 3. Final project *1. Tugas* *2. Evaluasi Tengah Semester* *3. Proyek Akhir*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: - Wallace, M., Webber, L. (2021). IT Governance: Policies & Procedures. Wolters Kluwer, New York - TOGAF 9 Foundation Study Guide 4th edition - COBIT 2019 Framework: Governance and Management Objectives - ArchiMate Modeling. Tautan: https://www.archimatetool.com/. Supporting: - Frogeri, R. F., Pardini, D. J., Cardoso, A. M. P., Prado, L. Á., Piurcosky, F. P., & Junior, P. dos S. P. (2019). IT Governance in SMEs. International Journal of IT/Business Alignment and Governance, 10(1), 55–73. doi:10.4018/ijitbag.2019010104 - Janahi, L., Griffiths, M., & Al-Ammal, H. (2015). A conceptual model for IT Governance: A case study research. International Conference on Computer Vision and Image Analysis Applications. doi:10.1109/iccvia.2015.7351894 - Silva, E., & Chaix, Y. (2008). Business and IT Governance Alignment Simulation Essay on a Business Process and IT Service Model.

	Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS 2008). doi:10.1109/hicss.2008.83.

Semester 6

English

Course (*Mata Kuliah*)	**English (*Bahasa Inggris*)**
Code (*Kode Mata Kuliah*)	UG234914
Semester	6
Lecturer (*Dosen Pengampu*)	• Tim Dosen Bahasa Inggris
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The English as a characterizing course of ITS is designed to help students integrate skills and capability in English to meet academic needs and language needs in the industrial or professional scheme. *Mata Kuliah Bahasa Inggris sebagai mata kuliah penciri ITS dirancang untuk membantu mahasiswa mengintegrasikan keterampilan bahasa Inggris untuk memenuhi kebutuhan akademik dan kebutuhan kebahasaan di dunia kerja.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to create (construct; create, design; develop) text summaries in the form of written visualizations in the form of text summaries or diagrams or tables by applying the principles of text structure. (Output: Reading report: comprehension, vocabulary in context, identifying text structure, constructing diagram or table). 2. Students are able to write (write; create; made; develop) five paragraph essays by applying the

	structure of essay writing correctly (Output: 5-paragraph essay) evaluation using rubric 3. Students are able to make academic presentations by applying presentation strategies correctly. (Output: Academic Presentation) evaluation using rubric 4. Students are able to integrate language skills for preparation needs for the world of work. (Output: job interview and cover letter) evaluation using rubric *1. Mahasiswa mampu membuat (construct; create, design; develop) ringkasan teks dalam bentuk visualisasi tertulis dalam bentuk text summary maupun diagram atau table dengan menerapkan prinsip-prinsip struktur teks. (Luaran: Reading report: comprehension, vocabulary in context, identifying text structure, constructing diagram or table).* *2. Mahasiswa mampu menulis (write; create; made; develop) lima paragraph essay dengan menerapkan struktur penulisan essay dengan benar (Luaran: 5-paragraph essay) evaluasi menggunakan rubric* *3. Mahasiswa mampu melakukan presentasi akademik dengan menerapkan strategi presentasi dengan benar. (Luaran: Academic Presentation) evaluasi menggunakan rubric* *Mahasiswa mampu mengintegrasikan keterampilan berbahasa untuk kebutuhan persiapan menghadapi dunia kerja. (Luaran: job interview and cover letter) evaluasi menggunakan rubric*
Content (*Materi Pembelajaran*)	• Reading Strategies: Skimming, Scanning, Reading for detail comprehension • Vocabulary in context • Text Organization/text structure • Signal words for text organization • Sentence Structure • Paragraph • Writing Process

	• Essay Writing • The Structure of an Essay • Writing an Essay • References • Citation • Academic Presentation • Planning: Establishing the context • Structuring Your Presentation • Using Visual Aids • Delivering your speech • Dos and Don'ts • English for Workplace • Addressing Selection Criteria • Writing Your CV/Resume • Writing Your ApplicationvAt The Interview 1. Strategi Membaca: Skimming, Scanning, Reading untuk pemahaman detail 2. Kosakata dalam konteks 3. Organisasi Teks/struktur teks 4. Kata-kata sinyal untuk organisasi teks 5. Struktur Kalimat 6. Paragraf 7. Proses penulisan 8. Penulisan esai 9. Struktur esai 10. Menulis esai 11. Referensi 12. Kutipan 13. Presentasi akademik 14. Perencanaan: menetapkan konteks 15. Menyusun presentasi 16. Menggunakan alat bantu visual 17. Menyampaikan pidato 18. Anjuran dan larangan 19. Bahasa Inggris untuk tempat kerja 20. Mengatasi kriteria seleksi 21. Menulis CV / Resume 22. Menulis aplikasi saat wawancara

Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Hogue Ann, Oshima Alice, "Introduction to Academic Writing", Longman,1997 2. Johnston Susan S, Zukowski Jean/Faust, "Steps to Academic Reading," Heinle, Canada, 2002 3. Mikulecky, Beatrice S, "Advanced Reading Power", Pearson Education, New York, 2007 4. Fellag Linda Robinson, "College Reading," Houghton Mifflin Company, 2006 5. Hague Ann, " First Steps in Academic Writing," Addison Wesley Publishing Company, 1996 6. Weissman Jerry, "Presenting to Win, the Art of Telling Your Story, Prentice Hall, 2006 7. Becker Lucinda & Joan Van Emden, "Presentation Skills for Students, Palgrave, Macmillan, 2010 8. Barbara Chivers and Michael Shoolbred, Student's Guide to Presentation, Making Your Presentation Count, SAGE Publication, 2007 9. Godwin, J. (2014). Planning Your Essay. 2nd ed. Basingstoke: Palgrave-MacMillan 10. University of Leicester. (2012). Writing Essays. Axailable from 11. University of Essex. (2008). How to improve your academic writing. Available from 12. Cooper, H. and Shoolbred, M. (2016). Where's your argument? London: Palgrave. 13. Anderson, L.W., Krathwohl, D.R. 2001. A Taxonomy for Learning, Teaching, and Assesing: A Revision of Bloom's Taxonomy of

	14. Educatioanl Objectives. New York: Addison Wesley Longman, Inc. 15. Oshima A. & Hogue, A. Writing Academic English (1998) NY: Addison Wesley Longman 16. Anderson, M & Anderson, K. 2003, Text Types in English 3, South Yarra: Macmillan Education Australia PTY LTD Macmillan. 17. Jordan, R.R. 2012, English for Academic Purposes, Cambridge: Cambridge University Press. 18. Dokumen Kurikulum - 382 19. Nunan, D. 1999. Second Language Teaching and Learning, Heinle &Heinle Publisher Boston. 20. Harmer, J. 2003. How to Teach English: An Introduction to the Practice of English Language Teaching. England: Pearson Education 21. Limited. 22. Valerir Ellery, 2005, Creating Strategic Readers, Florida: International Reading Association, Inc. 23. Bochner, D. 2007. Professional English Reader. Adelaide: School of Humanities, Flinders University 24. Richard J.C. & Renandya W. 2010. Methodology in Language Teaching, Cambridge: Cambridge University Press Supporting (*Pendukung*): 1. Root Christine & Blanchard Karen, " Ready to Read Now, Pearson Education, New York, 2005 2. Root Christine & Blanchard Karen, " Ready to Write, Pearson Education, New York, 2003 3. Bonamy David, "Technical English," Pearson Education, New York, 2011 4. Fellag Linda Robinson, "College Reading," Houghton Mifflin Company, 2006 5. Fuchs Marjorie & Bonner Margaret, " Focus on Grammar; An Integrated Skills Approach," Pearson Education, Inc, 2006 6. Hague Ann, " First Steps in Academic Writing," Addison Wesley Publishing Company, 1996

Technopreneurship

Course (*Mata Kuliah*)	**Technopreneurship (*Kewirausahaan Berbasis Teknologi*)**
Code (*Kode Mata Kuliah*)	UG234915
Semester	6
Lecturer (*Dosen Pengampu*)	• Muchammad Nurif, SE., MT • Yuni Setyaningsih, S.K.Pm., M.Sc. • Muhammad Ubaidillah Al Mustofa, M.SEI • Tim Dosen Technopreneurship ITS
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This course provides students with understanding and skills to be able to identify, and evaluate technology-based business opportunities in accordance with students' areas of expertise, and be able to develop business opportunities using Digital Marketing (Artificial Intelligence). This course combines an integrated introduction to theory and hands-on experience in developing ideas and business opportunities. In the end, students are expected to be able to pour business opportunities in the form of prototypes or products that are ready to be sold and effective business plans as a team to be exhibited at the end of the course *Mata kuliah ini memberikan pemahaman dan skill kepada mahasiswa untuk mampu mengidentifikasi, dan*

	mengevaluasi peluang usaha berbasis teknologi sesuai dengan bidang keahlian mahasiswa, serta mampu mengembangkan peluang usaha dengan menggunakan Digital Marketing (Artificial Intelligence)). Mata kuliah ini menggabungkan pengenalan teori dan praktek langsung (hands-on experience) secara terintegrasi dalam mengembangkan ide dan peluang usaha. Pada akhirnya mahasiswa diharapkan mampu menuangkan peluang usaha dalam bentuk prototype atau product yang sudah siap dijual dan business plan yang efektif secara tim untuk dipamerkan pada akhir mata kuliah
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to adapt to the situation at hand and survive in uncertain conditions by performing appropriate feasibility analysis calculations. 2. Able to innovate and be creative to produce market-oriented technology-based product designs (prototypes) by utilizing Artificial Intelligence. 3. Able to compile attractive business plan proposals and able to persuade investors. 4. Able to formulate a model digital marketing. 5. Formulate the needs of HR aspects and operational aspects based on the stages manifested in the simulation to build a sense of team responsibility that prioritizes business ethics. 6. Able to draw up a financial plan in a business proposal. 7. Able to create simple web content and perform optimization of simple web pages. *1. Mampu beradaptasi terhadap situasi yang dihadapi dan bertahan dalam kondisi yang tidak pasti dengan melakukan perhitungan analisa kelayakan yang tepat.* *2. Mampu berinovasi dan berkreasi untuk menghasilkan desain produk (prototype) berbasis teknologi yang berorientasi pasar dengan memanfaatkan Artificial Intelligence.* *3. Mampu menyusun proposal business plan yang menarik dan mampu mempersuasif ke pihak investor.*

	4. Mampu merumuskan model Digital Marketing. *5. Merumuskan kebutuhan aspek SDM dan aspek operasi berdasarkan tahapanya yang diwujudkan dalam simulasi untuk membangun rasa tanggung jawab tim yang mengedepankan etika bisnis.* *6. Mampu menyusun rencana keuangan dalam proposal bisnis.* *Mampu membuat konten web sederhana dan melakukan optimalisasi dari halaman web sederhana.*
Content (*Materi Pembelajaran*)	1. Technopreneur and Business 2. Recognizing Opportunities and Creating Business Ideas using Artificial Intelligence 3. Business Opportunity Feasibility Analysis 4. Developing an effective Business Model 5. Digital Marketing & Marketing Funnel 6. Make a simple 'Google My Business' Web 7. Operations and HR Management 8. Financial Management *1. Technopreneur dan Bisnis* *2. Mengenali Peluang dan Menciptakan Ide Bisnis menggunakan Artificial Intelligence* *3. Analisis Kelayakan Peluang Bisnis* *4. Mengembangkan Business Model yang effektif* *5. Digital Marketing & Marketing Funnel* *6. Membuat Web Sederhana Google My Business* *7. Manajemen Operasional dan SDM* *8. Manajemen Keuangan*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*):

	1. Technopreneurship. Tim Pengembangan Technopreneurship ITS (2015). Surabaya: ITS Press. Supporting (*Pendukung*): 1. Barringer, B. R., & Ireland, R. D. (2010). Entrepreneurship: Successfully launching new ventures. Upper Saddle River, N.J: Prentice Hall. 2. Osterwalder, A., Pigneur, Y., & Clark, T. (2010). Business model generation: A handbook for visionaries, game changers, and challengers. Hoboken, NJ: Wiley. 3. William, B. K., Sawyer, S. C., Berston, S., (2013). Business: A Practical Introduction. Upper Saddle River, N.J: Prentice Hall 4. International Labor Organization., (2014) Start and Improve Your Business: Implemetation Guide. ISBN: 9789221288060; 9789221288077 (web pdf) 5. International Labor Organization., (2015). Generate Your Business Idea. ISBN: 9789221287575; 9789221287582 (web pdf) 6. Kotler, Philip. 2010. Manajemen Pemasaran. Edisi tiga belas Bahasa Indonesia.Jilid 1 dan 2.Jakarta : Erlangga

Islam Religion

Course (*Mata Kuliah*)	**Islam Religion (*Agama Islam*)**
Code (*Kode Mata Kuliah*)	UG234901
Semester	6
Lecturer (*Dosen Pengampu*)	• Drs. Moh. Saifulloh, M.Fil.I • Drs. Zainul Muhibbin, M.Fil.I • Tim Dosen Agama Islam
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This Islamic Religious Education course discusses and explores materials with the substance of human relations with Allah to achieve a generation of piety with the Qur'anic paradigm; Human's relationship with fellow humans in order to integrate Iman, Islam and Ihsan; and human relations with their environment in order to grounding Islam to bring about prosperity. Thus was born a generation of religious, humanist, insightful and caring. *Mata kuliah Pendidikan Agama Islam ini membahas dan mendalami materi-materi dengan substansi relasi manusia dengan Allah untuk mewujudkan generasi bertakwa dengan paradigma Qur'ani; relasi mausia dengan sesama manusia dalam rangka mengintegrasikan Iman, Islam dan Ihsan; serta relasi manusia dengan lingkungannya dalam rangka*

	membumikan Islam untuk mewujudkan kesejahteraan. Dengan demikian lahirlah generasi religius, humanis, berwawasan luas dan memiliki kepedulian
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	*1.* Applying the essence of man's relationship with Allah, with fellow humans and with the natural environment in the Qur'anic paradigm (KK.1); *2.* Skilled in presenting the results of conceptual and/or empirical studies related to the essence and urgency of Islamic spirituality values as one of the determinants in building a nation with character (KK.2); *3.* Skilled in consistently behaving towards the coherence of the main teachings of Islam as the implementation of Iman, Islam, and Ihsan, and presenting Islam rahmatan lil alamin (KK.3); *4.* Understand the essence of Islamic Religious Education as a component of Compulsory Courses and its urgency as a spiritual value which is one of the determinants in building the nation's character (P.1); *5.* Understand the correlation between Islamic teachings and their contextualization in modern life as rahmatan lil alamin (P.3); *6.* Mastering the application of Islamic concepts about science, technology, social-humanities, and welfare problems of the ummah (P.4); *1. Menerapkan esensi relasi manusia dengan Allah, dengan sesama manusia dan dengan lingkungan alam dalam paradigma Qur'ani (KK.1);* *2. Terampil menyajikan hasil penelaahan konseptual dan/atau empiris terkait esensi dan urgensi nilai-nilai spiritualitas Islam sebagai salah satu determinan dalam pembangunan bangsa yang berkarakter (KK.2);* *3. Terampil bersikap secara konsisten terhadap koherensi pokok-pokok ajaran Islam sebagai implementasi Iman, Islam, dan Ihsan, serta menghadirkan Islam rahmatan lil alamin (KK.3);* *4. Memahami esensi Pendidikan Agama Islam sebagai komponen Mata Kuliah Wajib dan*

	urgensinya sebagai nilainilai spiritualitas yang menjadi salah satu determinan dalam pembangunan karakter bangsa (P.1); 5. *Memahami korelasi antara ajaran Islam dengan kontekstualisasinya dalam kehidupan modern sebagai rahmatan lil alamin (P.3);* 6. *Menguasai aplikasi konsep Islam tentang ilmu pengetahuan, teknologi, sosial-humaniora, dan masalah kesejahteraan umat (P.4);*
Content (*Materi Pembelajaran*)	• Building the Qur'anic Paradigm • God as a Spiritual Need • The Integration of Faith, Islam and Ihsan forms a Noble Moral • Religion Embodies Happiness • Grounding Islam in Indonesia • Religious Moderation Creates Unity in Diversity • Filantropi Islam - Zakat, Sedekah dan Wakaf • The Role and Function of Mosques for the Histories of the People • Islam Faces the Development of Science, Technology and Art • Curriculum Document – 428 • Islam's Contribution to the Development of World Civilization • *Membangun Paradigma Qur'ani* • *Manusia Bertuhan sebagai Kebutuhan Spiritual* • *Integrasi Iman, Islam dan Ihsan Membentuk Moral Mulia* • *Agama Mewujudkan Kebahagiaan* • *Membumikan Islam di Indonesia* • *Moderasi Beragama Mewujudkan Persatuan dalam Keberagaman* • *Filantropi Islam: Zakat, Sedekah dan Wakaf* • *Peran dan Fungsi Masjid untuk Kesejarteraan Umat* • *Islam Menghadapi Perkembangan Sain, Teknologi dan Seni* • *Kontribusi Islam dalam Pengembangan Peradaban Dunia*

Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Dirjen Pembelajaran dan Kemahasiswaan Kemenristekdikti. Pendidikan Agama Islam untuk Perguruan Tinggi, Jakarta, Dirjen Belmawa, 2016. 2. Wahyuddin, dkk. Pendidikan Agama Islam Membangun Karakter Mahasiswa di Perguruan Tinggi, Surabaya, 3. Penerbit Litera Jannata Perkasa, 2019. 4. Muhibbin, Zainul, dkk. Pendidikan Agama Islam Membangun Karakter Madani, Surabaya, ITS Press, 2012. Supporting (*Pendukung*): 1. Al Ghazali, Abu Hamid. (2011). Ihya' 'Ulumiddin. Jeddah: Dar al-Minhaj. 2. Hamka. Tasawuf: Perkembangan dan Pemurniannya. Jakarta: Pustaka Panji Mas, 1993. 3. Iberani, Jamal Syarif dkk. Mengenal Islam, Jakarta: eL-Kahfi, 2003. 4. Imarah, Muhammad. Islam dan Pluralitas: Perbedaan dan Kemajemukan dalam Bingkai Persatuan, Jakarta, Gema Insani, 1999 5. Qardhawi, Yusuf. Karakteristik Islam. Surabaya: Risalah Gusti, 1996. 6. Razaq, Nasruddin, Dinnul Islam, Bandung, Al-Ma,arif, 2005. 7. Tebba, Sudirman. Tasawuf Positif. Jakarta: Prenada Media, 2003. 8. Zaenal Aushop, Asep. Islamic Character Building, Membangun Insan Kamil Cendekia Berakhlak Qurani, Bandung: Salamadani, 2014

Christiany Religion

Course (*Mata Kuliah*)	**Christiany Religion (*Agama Kristen*)**
Code (*Kode Mata Kuliah*)	UG234902
Semester	6
Lecturer (*Dosen Pengampu*)	• Tim Dosen Agama Kristen ITS: • Imanuel C.O. Suryoadi, S.Sos., M.Pd.K.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Christian religious education provides insight to students to develop a complete, strong personality based on Biblical Truth and living together and apply science and technology responsibly *Pendidikan Agama Kristen memberikan wawasan kepada mahasiswa untuk mengembangkan kepribadian yang utuh dan tangguh berlandaskan pada kebenaran Alkitab dan kehidupan bersama, serta menerapkan iptek secara bertanggungjawab.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. The students have the capability to comprehend and accurately articulate the principles of Christianity. 2. The students grasp the true nature of humanity and the obligations that come with being devout believers

	3. The students have the ability to use the Word of God as the basis for their thoughts, words, and actions. 4. The students can put into practice the principles of Christianity in their social and civic lives. 5. The students possess a sense of moral and legal consciousness in their interactions within society 6. The students exhibit a spirit of tolerance and are adept at promoting peaceful coexistence. 7. The students comprehend the notion of science and technology from a Christian perspective and can harmoniously integrate their faith with their actions. 8. The students have the ability to distinguish between the principles of Christianity and cultural practices. 9. The students can embrace a democratic mindset and comprehend political discussions from the standpoint of Christian theology 10. The students possess Christian values and are prepared to contribute to a post-modern society, effectively applying these principles in their real-life experience *1. Mahasiswa mampu memahami dan menjelaskan ajaran Kristen dengan benar* *2. Mahasiswa memahami hakikat manusia dan tanggung jawab sebagai umat beragama* *3. Mahasiswa mampu menjadikan Firman Tuhan sebagai landasan berfikir, berkata, berprilaku* *4. Mahasiswa mampu mengimplementasikan nilai - nilai ajaran Kristen dalam kehidupan bermasyarakat dan bernegara.* *5. Mahasiswa memiliki kesadaran moral dan hukum dalam kehidupan bermasyarakat.* *6. Mahasiswa memiliki sikap toleransi dan mampu mewujudkan kerukunan.* *7. Mahasiswa memahami konsep IPTEKS dalam Kristen dan mampu mengintegrasikan iman, dan prilaku.*

	8. Mahasiswa mampu membedakan antara ajaran Kristen dengan kebudayaan. *9. Mahasiswa mampu bersikap demokratis, dan memahami wacana politik dalam perspektif teologi Kristen.* *10. Mahasiswa memiliki karakter Kristiani dan siap menjadi bagian dari masyarakat*
Content (*Materi Pembelajaran*)	• The connection between religion and humanity. • The role of God in Christian faith. • The understanding of human beings according to Christian teachings. • Ethics' influence on shaping Christian character. • The correlation between Christian faith and science and technology. • Promoting harmony among different religions. • Being stewards of God's creation. • Christian community or fellowship • *Agama dan Manusia,* • *Allah dalam Kepercayaan Kristen,* • *Manusia menurut Ajaran Kristen,* • *Etika dan Pembentukan Karakter Kriten,* • *Hubungan Iman Kristen dengan Ipteks,* • *Kerukunan Antar Umat Beragama,* • *Penjaga Ciptaan Allah,* • *Pergaulan Kristen*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*):

	1. Kemenristekdikti. 2016. Pendidikan Agama Kristen Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kemenristekdikti 2. Daniel Nuhamara, dkk, 2016, “Pendidikan Agama Kristen untuk Perguruan Tinggi Umum”, RISTEKDIKTI, Jakarta Supporting (*Pendukung*): 1. Hans Kung, 1999, “Etika Global”, Pustaka Pelajar, Yogyakarta. 2. Henry C. Thiessen, 1995, “Teologi Sistimatika”, Gandum Mas, Malang. 3. Herman Bavinck, 2011, “Dogmatika Reformed 1: Prolegomena”, Momentum, Surabaya. 4. Herman Bavinck, 2011, “Dogmatika Reformed 2: Allah dan Penciptaan, Momentum, Surabya. 5. J. Verkuyl, 1992, “Etika Kristen Ras, Bangsa dan Negara”, BPK Gunung Mulia, Jakarta. 6. J. Verkuyl, 1992, “Etika Kristen Bagian Umum”, BPK Gunung Mulia, Jakarta. 7. John M. Frame, 2004, “Doktrin Pengetahuan Tentang Allah”. Literatur SAAT, Malang. 8. K. Bertens, 2011, “Etika”, Gramedia, Jakarta. 9. Kenneth Richard Samples, 2015, “Without a Doubt, Literatur”, SAAT, Malang. 10. Millard J. Erickson, 1999, “Teologi Kristen”, Gandum Mas, Malang. 11. Norman L. Geisler, 2015, “Etika Kristen” Literatur SAAT, Malang. 12. Norman L. Geisler & Frank Turek, 2016, “I Don’t Enough Faith To Be An Atheis”, Literatur SAAT, Malang. 13. Paul Enns, 2008, “The Moody Handbook of Theology”, Literatur SAAT, Malang 14. R. C. Sproul, 2012, “Kebenaran-Kebenaran Dasar Iman Kristen”, Literatur SAAT, Malang.

Catholic Religion

Course (*Mata Kuliah*)	**Catholic Religion (*Agama Katolik*)**
Code (*Kode Mata Kuliah*)	UG234903
Semester	6
Lecturer (*Dosen Pengampu*)	• Tim Dosen Agama Katolik ITS: • Aurelius Ratu, S.S., M.Hum.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	*Students can explain the nature of humans as religious beings with faith and piety, apply moral behavior, and use the teachings of the Catholic Religion as a foundation for thinking and behaving in their work according to their field of expertise, both in individual and teamwork performance* *Mahasiswa mampu menjelaskan hakikat manusia sebagai makhluk religius yang memiliki iman dan ketakwaan, mampu mengaplikasikan perilaku moral, dan menjadikan ajaran Agama Katolik sebagai landasan berfikir dan berperilaku dalam berkarya sesuai bidang keahlian yang dimiliki, baik pada kinerja individu maupun kerjasama tim dalam kerja kelompok*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	
Content (*Materi Pembelajaran*)	• The Calling of Humanity according to the Scriptures

	• Human Relationships with Self, Others, the Environment, and God • Nurturing Faith in the Midst of Plurality • The Works of Jesus Christ and the Kingdom of God • The Church in the Context of Society • Christian Ethics • *Panggilan Hidup Manusia menurut Kitab Suci* • *Relasi Manusia dengan Diri, Sesama, Lingkungan, dan Tuhan* • *Iman dihidupi dalam pluralitas* • *Karya Yesus Kristus dan Kerajaan Allah* • *Gereja yang memasyarakat* • *Etika Kristiani*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Kemenristekdikti. 2016. Pendidikan Agama Katolik Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kemenristekdikti Supporting (*Pendukung*): 1. Konferensi WaliGereja Indonesia. Katekismus Gereja Katolik [cetakan 8]. Jakarta: KWI & Kanisius, 2013 2. Achmad, N. Pluralisme Agama, Kerukunan dalam Keragaman. Jakarta: Penerbit Buku Kompas, 2001. 3. Barbour, Ian G. Juru Bicara Tuhan antara Sains dan Agama. Bandung: Penerbit Mizan, 2000. 4. Griffin, David Ray. Tuhan dan Agama dalam Dunia Post Modern. Yogyakarta: Kanisius, 2005.

	5. Ismartono, SJ, I. Kuliah Agama Katolik Di Perguruan Tinggi Umum. Jakarta: Obor, 1993. 6. Sugiarto. I. Bambang. Agama Menghadapi Jaman. Jakarta: APTIK, 1992. 7. Leahy Louis. Filsafat Ketuhanan Kontemporer. Yogyakarta: Kanisius & BPK Gunung Mulia, 1994

Hindu Studies

Course (*Mata Kuliah*)	**Hindu Studies (*Pendidikan Agama Hindu*)**
Code (*Kode Mata Kuliah*)	UG234904
Semester	6
Lecturer (*Dosen Pengampu*)	• Dra.Ni Wayan Suarmini, M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The concept of the teachings of Hinduism has distinctive characteristics, this uniqueness lies in the customs and religious culture that underlies it. Therefore the transformation of the teachings of Hinduism is implemented and collaborated with local characteristics. Academically the Hindu Religious Education course discusses and explores materials with the substance of human relations with Hyang Widdhi (God Almighty) to increase faith and piety (Sraddha and bhakti); human relations with fellow human beings in building a humanist civilization; as well as human relations with their environment in realizing prosperity (jagadhita), so as to be able to form Hindus and Indonesians who are independent humanists, responsible and have social concern *Konsep ajaran Agama Hindu memiliki karakteristik yang khas,kekhasan itu terletak pada adat dan budaya keagamaan yang melandasinya. Olehkarena itu transformasi ajaran Agama Hindu terimplementasikan*

	dan terkolaborasi dengan kekhasan setempat. Secara akademik mata kuliah Pendidikan Agama Hindu membahas dan mendalami materi-materi dengan substansi relasi manusia dengan Hyang Widdhi (Tuhan yang Maha Esa) untuk peningkatan iman dan taqwa (Sraddha dan bhakti); relasi manusia dengan sesama manusia dalam membangunan peradaban yang humanis; serta relasi manusia dengan lingkungannya dalam mewujudkan kesejahteraan (jagadhita), sehingga mampu membentuk insan Hindu dan manusia Indonesia yang humanis mandiri, bertanggung jawab dan memiliki kepedulian sosial
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to understand Hindu Philosophy (Tattwa) in building sraddha and devotion (faith and piety) to God Almighty (Sanghyang Widdhi Wasa) to shape religious attitudes and character 2. Able to apply the values of Hindu Ethics to uphold human values in forming a personality that is virtuous, sensitive to social and environmental problems, and upholds cultural differences and pluralism 3. Being able to assess Hindu events can increase Hindu morality and spirituality in association with the wider community 4. Able to project Hindu values in making a real contribution to solving problems by implementing information and communication technology with sustainable principles and technology-based entrepreneurship 1. *Mampu memahami Filsafat Agama Hindu (Tattwa) dalam membangun sraddha dan bhakti (iman dan taqwa) kepada Tuhan Yang Maha Esa (Sanghyang Widdhi Wasa) untuk membentuk sikap dan karakter religious* 2. *Mampu menerapkan nilai-nilai Etika Hindu untuk menjunjung tinggi nilai-nilai kemanusiaan dalam membentuk kepribadian yang berbudi pekerti luhur,peka terhadap masalah social dan lingkungan, serta menjunjung tinggi perbedaan budaya dan kemajemukan*

	3. *Mampu menilai Acara Hindu dapat meninggkatkan moralitas dan spiritualitas Hindu dalam pergaulan di Masyarakat* 4. *Mampu memproyeksikan nilai-nilai Hindu dalam berkontribusi nyata untuk menyelesaikan masalah dengan mengimplementasikan teknologi informasi dan komunikasi dengan prinsip berkelanjutan serta kewirausaha berbasis teknologi*
Content (*Materi Pembelajaran*)	• Purpose and function of Hindu religion course • History of Hinduism • Brahmavidya/Hindu Theology • Veda • Humans in Hindu perspective • Hindu ethics/morals • Yadnya • Religious art • Harmony • Deradicalization in Hindu perspective • *Tujuan dan Fungsi Pendidikan Agama Hindu* • *Sejarah agama Hindu* • *Brahmavidya/Teologi Hindu* • *Veda* • *Manusia dalam perspektif Hindu* • *Etika/susila Hindu* • *Panca Maha Yadnya* • *Seni keagamaan* • *Kerukunan Beragama* • *Moderasi Beragama Dalam Perspektif Hindu*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom

Reading list (*Pustaka*)	Main (*Utama*): 1. Direktorat Jenderal Pembelajaran dan Kemahasiswaan, 2016, Pendidikan Agama Hindu untuk Perguruan Tinggi, Kemenristek Dikti RI Supporting (*Pendukung*): 1. Singer, Wayan, 2012. Tattwa (Ajaran Ketuhanan Agama Hindu, Surabaya, Paramita 2. Tim Penyusun, 1997, Pendidikan Agama Hindu Untuk Perguruan Tinggi, Hanuman Sakti 3. Wiana, 1994, Bagaimana Hindu Menghayati Tuhan, Manikgeni . 4. Wiana, 1982, Niti Sastra, Ditjen Hindu dan Budha. 5. Titib, 1996, Veda Sabda Suci Pedoman Praktis Kehidupan, Paramita. 6. Pudja, 1997, Teologi Hindu, Mayasari 7. Surpa,Wayan,2015, Hakikat Dan Martabat Manusia Dalam Agama Hindu Dan Norma-norma yang Ada Di Dalam Masyarakat Indonesia,UPT. PPKB. UNUD, 8. Kementrian Agama RI, 2019, Moderasi Beragama, Badan Litbang dan Diklat Kementrian RI

Budhist Studies

Course (*Mata Kuliah*)	**Budhist Studies (*Pendidikan Agama Buddha*)**
Code (*Kode Mata Kuliah*)	UG234905
Semester	6
Lecturer (*Dosen Pengampu*)	• Tim Dosen Agama Buddha ITS
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Buddhist education imparts students with the wisdom to cultivate a holistic and resilient character, rooted in the teachings of the Tripitaka Scriptures and communal living, while also encouraging responsible utilization of science and technology. *Pendidikan Agama Buddha memberikan wawasan kepada mahasiswa untuk mengembangkan kepribadian yang utuh dan tangguh berlandaskan pada kebenaran Kitab Suci Tripitaka dan kehidupan bersama, serta menerapkan iptek secara bertanggungjawab.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	•
Content (*Materi Pembelajaran*)	• The Tipitaka/Tripitaka Texts • Philosophy and History of Buddhist and Human Life Meaning • Buddhism's laws are universal.

	• The Buddhist Concept and Meaning of the ONE ALMIGHTY GOD • Moral values as guiding principles in human existence (Sila) • Buddhism's perspective on science and technology in human existence. • The Buddhist society concept and inter-religious peace. • The Meaning and Importance of Buddhist Cultural and Political Dynamics in the National Context • *Kitab Suci Tipitaka/Tripitaka* • *Filosofi dan Histori Makna Agama Buddha dan Kehidupan MAnusia* • *Hukum – hukum dalam Agama Buddha yang bersifat universal* • *Konsep dan Makna KETUHANAN YANG MAHA ESA dalam Agama Buddha* • *Nilai-nilai kemoralan sebagai pedoman hidup manusia (Sila)* • *Ilmu Pengetahuan dan Teknologi dalam kehidupan manusia dalam pandangan Agama Buddha.* • *Konsep masyarkat Buddha dan kerukunan antar umat beragama.* • *Konsep dan Urgensi Dinamika Budaya dan Politik Buddha dalam konteks kebangsaan*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*):

	1. Kemenristekdikti. 2016. Pendidikan Agama Buddha Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kemenristekdikti Supporting (*Pendukung*):

Confucian Studies

Course (*Mata Kuliah*)	**Confucian Studies (*Pendidikan Agama Konghucu*)**
Code (*Kode Mata Kuliah*)	UG234906
Semester	6
Lecturer (*Dosen Pengampu*)	• Tim Dosen Agama Konghucu ITS • Setio Kuncoro
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This Confucian Religion study discusses the Ru-Confucian religion as a Religious Philosophical religion and seeks an understanding of the scriptures, the purpose of life and after life, the activities that should be carried out in an effort to live life as a Junzi, how the creation of the universe and humans and their relation to the nature of existence. as human beings, suffering, trials and disasters, divinity and faith in the Ru-Confucian religion, Prophets and Prophets, Shenming and gods and their relation to houses of worship, worship and religious holidays and the basic values contained therein, which are not apart from studies based on the concept of yin-yang, Tian Di Ren and history are expected to encourage clergy and students to have faith and moral ethics that are applied in daily life because of their belief that only Virtue is acceptable before TIAN. With this learning, the clerics (lecturers) understand that to

	achieve their true goals as human beings and guide students to understand their goals and achieve their true goals as human beings, a conscious and faith-filled effort is needed to apply the Religious and Philosophical values of the Ru-Confucian religion in physical life. and spiritual. *Pembelajan Agama Khonghucu ini mendiskusikan agama Ru-Khonghucu sebagai agama yang Religious Filosofis dan mencari kesepahaman mengenai kitab suci, tujuan hidup dan setelah kehidupan, aktifitas yang seharusnya dilakukan dalam upaya menjalani hidup sebagai seorang Junzi, bagaimana penciptaan alam semesta dan manusia serta kaitannya dengan hakikat keberadaan sebagai manusia, penderitaan, cobaan dan bencana, Ketuhanan dan keimanan dalam agama Ru-Khonghucu, Nabi dan Kenabian, Shenming dan dewa serta kaitannya dengan rumah ibadat, peribadatan dan hari-hari besar keagamaan beserta nilai-nilai dasar yang terkandung di dalamnya, yang tidak terlepas dari kajian yang berdasarkan konsep yin-yang, Tian Di Ren dan sejarah yang diharapkan mendorong rohaniwan dan mahasiswa mempunyai iman dan etika moral yang diaplikasikan dalam kehidupan sehari-hari karena keyakinannya bahwa Hanya Kebajikan yang berkenan di hadapan TIAN. Dengan pembelajaran ini, rohaniwan Pembina (dosen) memahami bahwa untuk mencapai tujuannya yang hakiki sebagi manusia serta membimbing mahasiswa memahami tujuan dan mencapai tujuannya yang hakiki sebagai manusia, diperlukan upaya sadar dan penuh iman untuk mengaplikasikan nilai Religious dan Filosofis agama Ru-Khonghucu dalam kehidupan jasmani dan rohaninya.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Comprehending the principles of Confucian Philosophy in fostering belief and devotion to the Supreme Deity 2. Grasping the essence of Confucian Ethics to prioritize human values in molding an individual's character marked by honesty, law-abidance, creativity, well-being, and adaptability.

	3. Utilizing Confucian Ritual Values to elevate the moral and spiritual aspects of Confucian beliefs. 4. Capable of manifesting Confucian values in a global context 1. *Memahami Filsafat Konghucu dalam membangun iman dan taqwa kepada Tuhan Yang Maha Esa* 2. *Memahami ajaran Etika Konghucu untuk menjunjung tinggi nilai-nilai kemanusiaan dalam membentuk kepribadian yang jujur,taat hukum, kreatif, sehat dan adaptif* 3. *Mampu mengamalkan Nilai-nilai Ritual Konghucu untuk meninggkatkan moralitas dan spiritualitas Konghucu* 4. *Mampu mewujudkan nilai-nilai Konghucu dalam pergaulan global*
Content (*Materi Pembelajaran*)	• Ru-Khonghucu religion • The Purpose of Human Life • Creation of the Universe and Man • Divinity • Prophet • Shen Ming • Place of Worship, The Great Day of Religion • Trees of Faith • *Agama Ru-Khonghucu* • *Tujuan Hidup Manusia* • *Penciptaan Alam Semesta dan Manusia* • *Ketuhanan* • *Nabi* • *Shen Ming* • *Tempat Ibadah, Hari Besar Agama* • *Pokok-Pokok Keimanan*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis*

	3. Evaluasi Tengah Semester *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Kemenristekdikti. 2016. Pendidikan Agama Konghucu Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kemenristekdikti Supporting (*Pendukung*): 1. Xs. Tjhie Tjay Ing dkk, Hidup Bahagia dalam Jalan Suci Tian, Gerbang Kebajikan Ru, 2010 2. Yu Dan, 1000 Hati Satu Hati, Gerbang Kebajikan Ru, 2009

Civics

Course (*Mata Kuliah*)	**Civics (*Kewarganegaraan*)**
Code (*Kode Mata Kuliah*)	UG234913
Semester	6
Lecturer (*Dosen Pengampu*)	• Dra. Ni Wayan Suarmini, M.Sc • Niken Prasetyawati, SH, MH • DR. Tony Hanoraga, SH, MH
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Learning Citizenship is basically learning about Indonesianness, learning to become human beings with Indonesian personality, building a sense of nationality, respecting pluralism, upholding just law enforcement and loving the Indonesian homeland. To become a good Indonesian citizen, one must understand Indonesianness, have a sense of nationality and love for the Indonesian homeland, so that one can become a good and educated citizen (smart and good citizen) in a democratic society, nation and state based on Pancasila and the 1945 Constitution. *Belajar Kewarganegaraan pada dasarnya adalah belajar tentang ke-Indonesiaan , belajar untuk menjadi manusia yang berkepribadian Indonesia, membangun rasa kebangsaan, menghargai kemajemukan , menjunjung tinggi penegakan hukum yang berkeadilan dan mencintai tanah air Indonesia. Untuk menjadi*

	warga negara Indonesia yang baik harus memahami tentang ke-Indonesiaan , memiliki rasa kebangsaan dan mencintai tanah air Indonesia, sehingga dapat menjadi warga negara yang baik dan terdidik (Smart and good citizen) dalam kehidupan bermasyarakat,berbangsa dan bernegara yang demokratis berdasarkan Pancasila dan Undang-Undang Dasar 1945.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	*1.* Able to understand the concept of smart and good citizen based on Pancasila and the 1945 Constitution *2.* Able to apply attitudes and values as citizens who have Indonesian personality, have disciplined competitiveness and actively participate in building the life of the Republic of Indonesia based on Pancasila *3.* Able to integrate the attitudes and values of citizens who comply with the implementation of law in Indonesia *4.* Able to make a real contribution to solving problems by implementing information and communication technology, with the principles of sustainability and technology-based entrepreneurship *1. Mampu memahami konsep smart and good citizen berdasarkan Pancasila dan UUD 1945* *2. Mampu menerapkan tata sikap dan tata nilai sebagai warga negara yang berkepribadian Indonesia, memiliki daya saing berdisiplin dan berpartisifasi aktif dalam membangun kehidupan negara Republik IndonesiaI berdasarkan Pancasila* *3. Mampu mengintegrasikan sikap dan nilai warga negara yang patuh pada pelaksanaan hukum di Indonesia* *4. Mampu berkontribusi nyata untuk menyelesaikan masalah dengan mengimplementasikan teknologi informasi dan komunikasi , dengan prinsip keberlanjutan serta kewirausahaan berbasis teknologi*
Content (*Materi Pembelajaran*)	• The nature and challenges of citizenship for the future of the nation

	• National Identity • National Integration • The State and the Constitution • Harmony of Obligations and Rights of the State and Citizens and Human Rights • Indonesian Democracy • Equitable Law Enforcement • Archipelagic Outlook and Regional Autonomy • National Resilience and State Defense • Anti-Corruption Education • *Hakikat dan tantangan Kewarganegaraan bagi masa depan bangsa* • *Identitas Nasional* • *Integrasi Nasional* • *Negara dan Konstitusi* • *Harmoni Kewajiban dan Hak Negara dan warganegara dan Hak Asasi Manusia* • *Demokrasi Indonesia* • *Penegakan Hukum Yang Berkeadilan* • *Wawasan Nusantara dan Otonomi Daerah* • *Ketahanan Nasional dan Bela Negara* • *Pendidikan Anti Korupsi*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Kemenristekdikti. 2016. Modul Pendidikan Kewarganegaraan Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kemenristekdikti Supporting (*Pendukung*):

	1. Armaidy Armawi, Geostrategi Indonesia, Jakarta, Direktorat jenderal Pendidikan Tinggi, 2006 2. Azyumardi Azra, paradigma Baru Pendidikan Nasional dan Rekrontruksi dan Demokratisasi, Penerbit Kompas, Jakarta, 2002 3. Bahar, Dr. Saefrodin, “Konteks Kenegaraan, Hak Asasi Manusia, Pustaka Sinar Harapan, Jakarta, 2000. 4. Kaelan, Pendidikan Kewarganegaraan, UGM Press, Yogyakarta 2005. 5. Slamet Soemiarno, Geopolitik Indonesia, Jakarta, Direktorat Jenderal Pendidikan Tinggi, 2006 6. 8. Panduan Insersi Pendidikan Antikorupsi Dalam Mata Kuliah Pendidikan Kewarganegaraan,KPK, 2019

Mobile Programming

Course (*Mata Kuliah*)	**Mobile Programming (Pemrograman Perangkat Bergerak)**
Code (*Kode Mata Kuliah*)	EF234601
Semester	6
Lecturer (*Dosen Pengampu*)	• Dr. Dwi Sunaryono, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	In this lecture, the concept of mobile programming using Android is discussed. In this lecture will be discussed topics related to developer devices (Android Studio), concepts in mobile programming which include: Activity, Fragment, Recycler View, Async task, shared preferences, APK build, material design, utilities, camera and gallery access, GPS, GCM and push notifications, local databases. It is expected that the mobile application created can also connect to the server in the internet network. *Dalam perkuliahan ini dibahas mengenai konsep pemrograman bergerak menggunakan Android. Dalam kuliah ini akan dibahas topik terkait perangkat pengembang (Android Studio), konsep-konsep dalam pemrograman bergerak yang meliputi: Activity, Fragment, Recycler View, Async task, shared preferences, build APK, material design, utilities, akses kamera dan gallery, GPS, GCM dan push notification,*

	database lokal. Diharapkan aplikasi perangkat bergerak yang dibuat juga dapat terhubung dengan server dalam jaringan internet
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students understand the concepts and applications of mobile programming 2. Students understand the concept of mobile programming with various platforms. 3. Students are able to make programs on medium-scale Android devices, both individually and in teamwork 4. Students are able to create large-scale mobile programs with sensors and connect to servers 1. *Mahasiswa memahami konsep dan terapan dari pemrograman perangkat bergerak* 2. *Mahasiswa memahami konsep pemrograman perangkat bergerak dengan berbagai platform* 3. *Mahasiswa mampu membuat program pada perangkat Android dalam skala menengah, baik secara individual maupun kerja sama tim* 4. *Mahasiswa mampu membuat program mobile skala besar dengan sensor perangkat bergerak dan terhubung ke server*
Content (*Materi Pembelajaran*)	• Views and Android Studio • Activity • Introduction to project components and fragments • Fragment, themes, dand custom drawable • Recycler View (adapter and custom item view) • Async Task (background process and request to the internet) • SharedPreference, APK Build • Simple Material Design and animation • Utilities and class abstractions • Camera and gallery access • GPS • GCM and push notification • Local database • *Views dan Android Studio* • *Activity*

	• *Pengenalan komponen pada project dan fragment* • *Fragment, tema, dan custom drawable* • *Recycler View (adapter dan custom item view)* • *Async Task (background process dan request ke internet)* • *SharedPreference, build APK, dan demo progress Final Proyek* • *Material Design dan animasi sederhana* • *Utilities dan abstraksi kelas* • *Akses kamera dan gallery* • *GPS dan demo progress final project* • *GCM dan push notification* • *Database local*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Pierre-Olivier Laurence, Amanda Hinchman-Dominguez, Mike Dunn, G. Blake Meike, Programming Android with Kotlin, 2021, O'Reilly Media, Inc. 2. John Horton, Android Programming with Kotlin for Beginners, 2019, Packt Publishing Supporting (*Pendukung*): 1. Dawn Griffiths, David Griffiths, Head First Kotlin: A Brain-Friendly Guide, 2019, O'Reilly Media, Inc. 2. Android Developer Guide, https://developer.android.com/docs

Human-Computer Interaction

Course (*Mata Kuliah*)	**Human-Computer Interaction (Interaksi Manusia dan Komputer)**
Code (*Kode Mata Kuliah*)	EF234602
Semester	6
Lecturer (*Dosen Pengampu*)	• Hadziq Fabroyir, S.Kom., Ph.D., • Dr. Anny Yuniarti, S.Kom., M.Comp.Sc • Siska Arifiani, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	4. Lectures (*Tatap muka*): 3x50'/week 5. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 6. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Rekayasa Perangkat Lunak
Course Description (*Deskripsi Mata Kuliah*)	Human-Computer Interaction (HCI) is becoming increasingly important in interactive software. In interactive software engineering, the functionality and efficiency of algorithms are no longer sufficient as complete quality measures. The quality of interactive software is also increasingly being judged from the external view of its users regarding their expectations, satisfaction, and experiences. HCI's role is even more critical, considering that everything around us has become digital. This HCI course will involve various non-computer disciplines such as psychology, ergonomics, anthropology, and visual communication design to answer external challenges from the user's point of view mentioned above. By joining this course, students are expected to be able to apply the principles of good interaction in the development of interactive software and evaluate the usability of the software.

	Interaksi Manusia dan Komputer (IMK) menjadi semakin penting dalam dunia perangkat lunak interaktif. Dalam rekayasa perangkat lunak yang interaktif, fungsionalitas dan efisiensi algoritme tidak lagi cukup sebagai ukuran kualitas yang paripurna. Pada kenyataannya, kualitas perangkat lunak interaktif juga semakin dinilai dari sudut pandang eksternal para penggunaanya berkenaan dengan harapan, kepuasan, dan pengalaman mereka. Peran IMK bahkan menjadi lebih kritis mengingat segala sesuatu di sekitar kita telah menjadi digital. Mata kuliah IMK ini akan melibatkan berbagai disiplin ilmu non komputer seperti psikologi, ergonomi, antropologi, dan desain komunikasi visual guna menjawab tantangan eksternal dari sudut pandang pengguna di atas. Dengan mengikuti kuliah ini, mahasiswa diharapkan mampu menerapkan prinsip - prinsip interaksi yang baik dalam pengembangan perangkat lunak interaktif dan mengevaluasi ketergunaan perangkat lunak tersebut
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to reason and discuss the importance of user-centered design on user interfaces for the development of interactive software *2.* Able to develop and utilize modeling concepts as well as user feedback to analyze and evaluate the interaction between humans and software considering the context of use *3.* Able to design intuitive software and user interfaces to create a natural interaction for universal users or those with disabilities 4. Ability to create and administer a simple usability test to analyze and evaluate a user interface considering the user's needs, performance, and preferences *1. Mampu menalar dan mendiskusikan pentingnya desain yang berpusat pada pengguna pada antarmuka pengguna untuk pengembangan perangkat lunak yang interaktif* *2. Mampu mengembangkan dan menggunakan konsep pemodelan serta umpan balik pengguna untuk menganalisis dan mengevaluasi interaksi*

	antara manusia dengan perangkat lunak dengan mempertimbangkan konteks penggunaan 3. *Mampu merancang perangkat lunak dan antarmuka pengguna yang intuitif guna mewujudkan interaksi yang alami bagi* 4. *Mampu membuat purwarupa perangkat lunak sederhana untuk memenuhi kebutuhan masyarakat yang berpedoman pada kaidah heuristik dan berpusat pada pengguna, kemudian melaporkan hasilnya* 5. *Mampu membuat dan melakukan uji ketergunaan sederhana untuk menganalisis dan mengevaluasi antarmuka pengguna dengan mempertimbangkan kebutuhan, kinerja, dan preferensi pengguna*
Content (*Materi Pembelajaran*)	• Human-computer interaction principles: Conceptual mapping, usability affordances • Feedback cycle • Direct manipulation • Design principles and heuristics • Mental model and representation • Human physical and cognitive abilities • User interface and experience design • Task analysis and user behavior • Sketches and prototypes • Usability Study • Emerging technologies in HCI: XR, ubiquitous computing, wearables, robotics, mobile devices • Application ideas: context-sensitive computing, gesture-based interaction, information visualization, social computing • Domains to which HCI applies: healthcare, education, security, gaming, people with special needs • *Prinsip-prinsip interaksi: Pemetaan konseptual, ketergunaan* • *Siklus timbal balik* • *Manipulasi langsung* • *Prinsip desain dan heuristik* • *Model mental dan representasi*

	• *Kemampuan fisik dan kognitif manusia* • *Desain antarmuka dan pengalaman pengguna* • *Analisis penugasan dan perilaku pengguna* • *Sketsa dan purwarupa* • *Studi ketergunaan* • *Teknologi IMK terkini* • *Ide aplikasi IMK* • *Domain aplikasi IMK*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Norman, D. (2013). The design of everyday things: Revised and expanded edition. Basic books. 2. Kim, G. J. (2015). Human-computer interaction: fundamentals and practice. CRC press. Supporting (*Pendukung*): 1. Wigdor, D., & Wixon, D. (2011). Brave NUI world: designing natural user interfaces for touch and gesture. Elsevier. 2. Krug, S. (2013). Don't Make Me Think, Revisited: A Common Sense Approach to Web. 3. Gilbert, R. M. (2019). Inclusive design for a digital world: Designing with accessibility in mind. Apress. 4. Rogers, Y., Sharp, H., & Preece, J. (2019). Interaction Design: Beyond Human-Computer Interaction, Wiley. 5. Johnson, J. (2020). Designing with the mind in mind: Simple guide to understanding user interface design guidelines. Morgan Kaufmann.

	6. David Joyner. Human-Computer Interaction. Georgia Tech at Udacity (https://learn.udacity.com/courses/ud400)

Capstone Project

Course (*Mata Kuliah*)	**Capstone Project (Capstone Project)**
Code (*Kode Mata Kuliah*)	EF234622
Semester	6
Lecturer (*Dosen Pengampu*)	•
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	
Course Description (*Deskripsi Mata Kuliah*)	
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	
Content (*Materi Pembelajaran*)	•
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	

Practical Work

Course (*Mata Kuliah*)	**Practical Work (Kerja Praktik)**
Code (*Kode Mata Kuliah*)	EF234603
Semester	6
Lecturer (*Dosen Pengampu*)	• Dr. Radityo Anggoro , S.Kom, M.Sc
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. 3 Month working at selected industy (*3 bulan bekerja di industri yang dipilih*)
Credit points (*SKS*)	4
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Practical Work Lecture is a lecture activity carried out to provide student experience in applying the knowledge gained in lectures into the world of work. Students are required to implement their competence to solve real problems in the world of work by spending more than 3 months in the company / practical work location *Kuliah Kerja Praktik merupakan kegiatan perkuliahan yang dilakukan untuk memberi pengalaman mahasiswa dalam menerapkan ilmu yang didapat pada perkuliahan kedalam dunia kerja. Mahasiswa dituntut mengimplementasikan kompetensinya untuk menyelesaikan permasalahan nyata didunia kerja dengan menghabiskan lebih dari 3 bulan diperusahaan/lokasi kerja praktik*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and define system needs. 2. Students are able to design proposed solutions to solve problems in the practical workplace 3. Students are able to apply the proposed solution method 4. Students are able to compile a final report

	1. *Mahasiswa mampu memahami dan mendefinisikan kebutuhan sistem.* 2. *Mahasiswa mampu merancang usulan solusi untuk permasalahan ditempat kerja praktik* 3. *Mahasiswa mampu menerapkan metode solusi yang diusulkan* 4. *Mahasiswa mampu menyusun laporan akhir*
Content (*Materi Pembelajaran*)	•
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Final Report 1. *Laporan Akhir*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	

Mobile Computing

Course (*Mata Kuliah*)	**Mobile Computing (*Komputasi Bergerak*)**
Code (*Kode Mata Kuliah*)	EF234604
Semester	6
Lecturer (*Dosen Pengampu*)	Bagus Jati Santoso, S.Kom, Ph.D
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Network (*Jaringan Komputer*)
Course Description (*Deskripsi Mata Kuliah*)	The Mobile Computing course provides knowledge about the unique characteristics of mobile environments. Students are guided to define problems that arise in mobile environments and are asked to design appropriate protocols to solve problems in mobile environments. *Kuliah Komputasi Bergerak memberikan pengetahuan tentang karakteristik unik yang ada pada lingkungan bergerak. Mahasiswa dibimbing untuk mendefinisikan permasalahan yang muncul pada lingkungan bergerak dan diminta untuk merancang protokol yang tepat untuk menyelesaikan permasalahan pada lingkungan bergerak.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand and explain the concepts and principles of architecture, systems and network fundamentals in a mobile environment. 2. Students are able to understand and define specific protocols according to the network layer based on the characteristics of the mobile environment. 3. Students are able to understand and apply protocols at the network layer both general and specific including performance measurement settings in a mobile environment. 4. Students are able to understand and apply protocol modifications to solve problems effectively and efficiently. 1. *Mahasiswa mampu memahami dan menjelaskan konsep dan prinsip arsitektur, sistem dan dasar - dasar jaringan pada lingkungan bergerak.* 2. *Mahasiswa mampu memahami dan mendefinisikan protokol yang spesifik sesuai pada network layer berdasarkan karakteristik lingkungan bergerak* 3. *Mahasiswa mampu memahami dan menerapkan protokol pada network layer baik yang umum ataupun yang spesifik termasuk pengaturan pengukuran performa pada lingkungan bergerak.* 4. *Mahasiswa mampu memahami dan menerapkan modifikasi protokol untuk menyelesaikan permasalahan secara efektif dan efisien*
Content (*Materi Pembelajaran*)	1. AL/Algorithmic Strategies 2. AL/Fundamental Data Structures and Algorithms 3. NC/Networked Applications 4. NC/Reliable Data Delivery 5. NC/Resource Allocation 6. NC/Routing And Forwarding 7. NC/Local Area Networks 8. NC/Mobility 9. PL/Advanced Programming Constructs 10. PL/Logic Programming

	1. *AL/Strategi Algoritmik* 2. *AL/Struktur dan Algoritma Data Dasar* 3. *NC/Aplikasi Jaringan* 4. *NC/Pengiriman Data yang Andal* 5. *NC/Alokasi Sumber Daya* 6. *NC/Perutean dan Penerusan* 7. *NC/Jaringan Area Lokal* 8. *NC/Mobilitas* 9. *PL/Konstruksi Pemrograman Lanjutan* 10. *PL/Pemrograman Logika*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Abdessalam Helal, Et.Al," Anytime, Anywhere Computing, Mobile Computing Concepts and Technology" , McGraw-Hill, 2. Mobile Computing Principles Designing And Developing Mobile Applications With Uml And Xml and the Environment", Oxford Publisher 2002. 3. Location Management and Routing in Mobile Wireless Networks, Amitava Mukherjee, Somprakash Bandyopadhyay, Debashis Saha, Artech House Publisher 4. Andreas Heinemann, Max Muhlhauser", Peer-to-Peer Systems and Application 5. Mohammad Ilyas and Imad Mahgoub, Mobile Computing Handbook, Auerbach Publication Supporting:

	1. IEEE Transaction of Mobile Computing, IEEE 2. Pervasive and Mobile Computing, Elsevier

Pervasive Computing and Sensor Networks

Course (*Mata Kuliah*)	**Pervasive Computing and Sensor Networks (*Komputasi Pervasif dan Jaringan Sensor*)**
Code (*Kode Mata Kuliah*)	EF234605
Semester	6
Lecturer (*Dosen Pengampu*)	Ir Ary Mazharuddin Shiddiqi, PhD
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Network (*Jaringan Komputer*)
Course Description (*Deskripsi Mata Kuliah*)	This subject discusses about the concept of pervasive computing, and the aspects that can be supported by the concept. This subject also discusses about the methods that support the implementation of pervasive computing such as smart devices, context-aware system and its interaction with daily life. *Mata kuliah ini membahas tentang bagaimana konsep komputasi pervasif, dan aspek-aspek yang mampu didukungnya. Didalamnya juga di bahas tentang bagaimana metode yang digunnakan untuk untuk menunjang penerapan komputasi pervasive seperti piranti cerdas, context-aware system dan interaksinya dengan kehidupan manusia.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to understand and implement wireless sensor network and its device 2. Able to understand the communication methods in wireless sensor network 3. Able to implement communication methods in wireless sensor networks *1. Mampu memahami pengetahuan dan implementasi jaringan sensor nirkabel dan piranti komputasi* *2. Mampu memahami metode komunikasi pada jaringan sensor nirkable* *3. Mampu mengimplementasikan metode komunikasi pada jaringan sensor nirkabel*
Content (*Materi Pembelajaran*)	1. Ubiquitous Computing 2. Human-Computer Interaction 3. Tagging, Sensing and Controlling 4. Micro Actuation and Sensing 5. Context-Aware Systems 6. Temporal Awareness 7. Intelligent Systems 8. Ubiquitous Communication *1. Komputasi di mana-mana* *2. Interaksi Manusia-Komputer* *3. Penandaan, Penginderaan, dan Pengendalian* *4. Aktuasi dan Penginderaan Mikro* *5. Sistem Sadar Konteks* *6. Kesadaran Temporal* *7. Sistem Cerdas* *8. Komunikasi di Mana-mana*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*

Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Singh, P. K., Bhargava, B. K., Paprzycki, M., Kaushal, N. C., & Hong, W.-C. (Eds.). (2020). Handbook of Wireless Sensor Networks: Issues and Challenges in Current Scenario's (Vol. 1132). Springer International Publishing. https://doi.org/10.1007/978-3-030-40305-8

Network Security

Course (*Mata Kuliah*)	**Network Security (*Keamanan Jaringan*)**
Code (*Kode Mata Kuliah*)	EF234606
Semester	6
Lecturer (*Dosen Pengampu*)	1. Prof. Tohari Ahmad 2. Dr. Baskoro Adi Pratomo
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Network (*Jaringan Komputer*)
Course Description (*Deskripsi Mata Kuliah*)	Network Security course will discuss techniques for securing applications, systems, and data on networks. Participants will start by learning about different types of malware and analyzing their behavior. Then, participants will learn how Intrusion Detection Systems work to detect attacks, honeypots to trap attackers and analyze their behavior, and logging to find out what happens to the system. In addition, participants will also learn concepts for securing Wifi networks and email delivery. And at the end, participants will recognize the non-technical aspects of cyber security, such as legal, ethical, and privacy.

	Mata kuliah Keamanan Jaringan akan membahas teknik-teknik pengamanan aplikasi, sistem, dan data pada jaringan. Peserta akan mulai dengan mempelajari berbagai jenis malware dan menganalisis perilakunya. Kemudian, peserta akan mempelajari cara kerja Intrusion Detection Systems untuk mendeteksi serangan, honeypots untuk menjebak penyerang dan menganalisis perilakunya, dan logging untuk mengetahui apa saja yang terjadi pada sistem. Selain itu, peserta juga akan belajar konsep untuk mengamankan jaringan Wifi dan pengiriman email. Dan di akhir, peserta akan mengenali aspek non teknis pada cyber security, seperti legal, etik, dan privasi.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the basic concepts of computer security. 2. Students are able to explain and identify various types of malicious software and are able to analyze a piece of software to find out if it is malicious. 3. Students are able to implement intrusion detection systems, firewalls, and honeypots to maintain system security and collect data. 4. Students are able to implement logging systems in Windows and Linux and analyze the results. 5. Students are able to explain the concept of securing wifi and email and about the concept of Transport Layer Security 6. Students are able to explain the basic concepts of legal and ethical aspects and privacy in computer security *1. Mahasiswa mampu menjelaskan konsep dasar keamanan komputer.* *2. Mahasiswa mampu menjelaskan dan mengidentifikasi berbagai jenis perangkat lunak berbahaya dan mampu menganalisis sebuah perangkat lunak untuk mengetahui apakah itu berbahaya*

	3. *Mahasiswa mampu mengimplementasikan sistem deteksi intrusi, firewall, dan honeypot untuk menjaga keamanan sistem dan mengumpulkan data.* 4. *Mahasiswa mampu mengimplementasikan sistem pencatatan di Windows dan Linux dan menganalisis hasilnya* 5. *Mahasiswa mampu menjelaskan konsep pengamanan wifi dan email serta tentang konsep Transport Layer Security* 6. *Mahasiswa mampu menjelaskan konsep dasar aspek legal dan etis serta privasi pada keamanan komputer*
Content (*Materi Pembelajaran*)	1. Malicious software dan analisis 2. Intrusion Detection Systems 3. Honeypots 4. Logging (Sysmon, Auditd, Syslog) 5. Keamanan Wifi dan Email 6. Aspek legal, etik, dan privasi pada cyber security 1. *Malicious software and analysis* 2. *Intrusion Detection Systems* 3. *Honeypots* 4. *Logging (Sysmon, Auditd, Syslog)* 5. *Wifi and Email Security* 6. *Legal, ethical, and privacy aspects of cyber security*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main:

	1. Computer Security: Principles and Practice, Fourth edition, William Stallings and Lawrie Brown 2. NETWORK SECURITY ESSENTIALS, SIXTH EDITION, William Stallings

Application Security

Course (*Mata Kuliah*)	**Application Security (*Keamanan Aplikasi*)**
Code (*Kode Mata Kuliah*)	EF234607
Semester	6
Lecturer (*Dosen Pengampu*)	1. Prof. Tohari Ahmad 2. Dr. Baskoro Adi Pratomo
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Organization (*Organisasi Komputer*) Operating System (*Sistem Operasi*)
Course Description (*Deskripsi Mata Kuliah*)	This Application Security course begins to discuss low-level security in desktop applications, including memory layout and its relationship to low-level attacks such as buffer overflow and format injection. To overcome these issues, students will also learn low-level attack prevention techniques such as Data Execution Prevention and Address Space Layout Randomization. Then, the Application Security course will move on to discuss attacks that can occur in web-based applications, such as SQL Injection, Cross Site Scripting, File Inclusion, and others. After that, the course will end with an introduction to the concept of DevSecOps, a secure application development that involves security factors since design. It will also

	discuss static and dynamic analysis in application development. *Mata kuliah Keamanan Aplikasi ini mulai membahas tentang low-level security pada aplikasi desktop, termasuk layout memori dan hubungannya dengan serangan-serangan low-level seperti buffer overflow dan format injection. Untuk mengatasi hal-hal tersebut, maka mahasiswa juga akan mempelajari teknik-teknik pencegahan serangan low-level seperti Data Execution Prevention dan Address Space Layout Randomisation. Kemudian, MK Keamanan Aplikasi akan beralih membahas serangan-serangan yang bisa terjadi pada aplikasi berbasis web, seperti SQL Injection, Cross Site Scripting, File Inclusion, dan lain-lain. Setelah itu, MK akan diakhiri dengan pengenalan konsep DevSecOps, pengembangan aplikasi secara aman yang melibatkan faktor keamanan sejak perancangan. Di dalamnya akan dibahas juga mengenai analisis statis dan dinamis pada pengembangan aplikasi.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to find low-level security holes in desktop applications 2. Students are able to explain and implement low-level attack prevention techniques 3. Students are able to analyze web-based applications to find existing security holes and implement their prevention 4. Students are able to explain and use the principles of secure application development 5. Students are able to explain and identify user authentication methods according to application needs *1. Mahasiswa mampu mencari celah keamanan low-level pada aplikasi desktop* *2. Mahasiswa mampu menjelaskan dan mengimplementasikan teknik-teknik pencegahan serangan low-level*

	3. *Mahasiswa mampu menganalisis aplikasi berbasis web untuk mencari celah keamanan yang ada dan mengimplementasikan pencegahannya* 4. *Mahasiswa mampu menjelaskan dan menggunakan prinsip-prinsip pengembangan aplikasi yang aman* 5. *Mahasiswa mampu menjelaskan dan mengidentifikasi metode autentikasi pengguna sesuai dengan kebutuhan aplikasi*
Content (*Materi Pembelajaran*)	1. Memory Layout, Buffer Overflow, Code Injection, Other Memory Exploits, Format String Vulnerabilities 2. Memory Safety, Type Safety, DEP, ASLR, Return Oriented Programming 3. DevSecOps: Design and Architecture, Coding, Integration and Testing, Delivery and Deployment, Runtime Defense and Monitoring 4. User Authentication 1. *Tata Letak Memori, Buffer Overflow, Injeksi Kode, Eksploitasi Memori Lainnya, Kerentanan Format String* 2. *Keamanan Memori, Keamanan Tipe, DEP, ASLR, Pemrograman Berorientasi Pengembalian* 3. *DevSecOps: Desain dan Arsitektur, Pengkodean, Integrasi dan Pengujian, Pengiriman dan Penyebaran, Pertahanan dan Pemantauan Runtime* 4. *Otentikasi Pengguna*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*

Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. William Stallings, Lawrie Brown: Computer Security Principles and Practice, 4th Edition 2. Andrew Honig and Michael Sikorski: Practical Malware Analysis 3. Peter Yaworski: Real World Bug Hunting 4. Chris Anley, Felix Lindner, and John Heasman: The Shellcoder's Handbook: Discovering and Exploiting Security

Interface Programming

Course (*Mata Kuliah*)	**Interface Programming (*Pemrograman Berbasis Antarmuka*)**
Code (*Kode Mata Kuliah*)	EF234608
Semester	6
Lecturer (*Dosen Pengampu*)	Dwi Sunaryono
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Web Programming (*Pemrograman Web*)
Course Description (*Deskripsi Mata Kuliah*)	The Interface Based Programming course is designed to provide knowledge for students related to interfaces between programming languages, application to applications and settings on servers. *Mata kuliah Pemrograman Berbasis Antarmuka dirancang untuk memberikan pengetahuan bagi mahasiswa berkaitan dengan antarmuka antar bahasa pemrograman, penerapan pada aplikasi dan setting pada server*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. 1.Students understand the concepts and applications of interface programming 2. 2.Students understand the concept of interfaces with various platforms

	3. 3.Students are able to create interface programs in a DBMS or noSQL, both individually and in teamwork 4. 4.Students are able to create interface programs in multiplatform *1. 1.Mahasiswa memahami konsep dan terapan dari pemrograman antar muka* *2. 2.Mahasiswa memahami konsep antar muka dengan berbagai platform* *3. 3.Mahasiswa mampu membuat program antar muka dalam suatu DBMS maupun noSQL, baik secara individual maupun kerja sama tim* *4. 4.Mahasiswa mampu membuat program antar muka dalam multiplatform*
Content (*Materi Pembelajaran*)	1. AL/Basic Analysis 2. AL/Advanced Data Structures, Algorithms, and Analysis 3. CN/Data, Information, and Knowledge 4. PL/Advanced Programming Constructs 5. PL/Logic Programming 6. SF/Parallelism 7. PL/Concurrency and Parallelism 8. PL/Runtime Systems 9. PL/Functional Programming 10. PD/Parallel Algorithms, Analysis, and Programming 11. PBD/Web Platforms 12. OS/Real Time and Embedded Systems *1. AL/Analisis Dasar* *2. AL/Struktur, Algoritma, dan Analisis Data Tingkat Lanjut* *3. CN/Data, Informasi, dan Pengetahuan* *4. PL/Konstruksi Pemrograman Tingkat Lanjut* *5. PL/Pemrograman Logika* *6. SF/Paralelisme* *7. PL/Konkurensi dan Paralelisme* *8. PL/Sistem Waktu Proses* *9. PL/Pemrograman Fungsional*

	10. PD/Algoritma, Analisis, dan Pemrograman Paralel *11. PBD/Platform Web* *12. OS/Waktu Nyata dan Sistem Tertanam*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Brajesh De, Et.Al," API Management" , Apress,2017 2. Sanjai Patni," Pro RESTful APIs", Apress 2017. 3. Lorna JM,"PHP Web Services", O'relly, 2016 Supporting: 1. Manohar Swamynathan," Mastering Machine Learning with Python in Six Steps",Apress, 2017 2. Allan Richardson, "Automating and Testing a REST API", 2017 3. Navin Kumar Manaswi,"Deep Learning with Applications Using Python,Apress,2018

Dynamic System Simulation

Course (*Mata Kuliah*)	**Dynamic System Simulation (*Simulasi Sistem Dinamis*)**
Code (*Kode Mata Kuliah*)	EF234609
Semester	6
Lecturer (*Dosen Pengampu*)	Joko Lianto Buliali
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Simulation Modeling (*Pemodelan Simulasi*)
Course Description (*Deskripsi Mata Kuliah*)	Dynamic System Simulation aims to provide students with the ability to understand Dynamic Systems, create Dynamic System models, and simulate Dynamic System models that are ultimately used as support for decision making on one or more simulated system parameters. Dynamic System Simulation combines the concepts of Dynamic System modeling, computation, and statistics. The application of Dynamic System Simulation can be found, among others, in the design of system and process models in the fields of industry, economics, biology, engineering and environment, etc. This course contains topics such as Dynamic Systems, modeling Dynamic Systems, population growth

	models in nature, ecological models of natural resources, production and inventory models, CO2 emission models, Quality Control models, epidemic outbreak models, mechanical movement models, interactive models, Input Output control, Sensitivity analysis. *Simulasi Sistem Dinamis bertujuan untuk memberikan mahasiswa kemampuan untuk memahami Sistem Dinamis, membuat model Sistem Dinamis, serta melakukan simulasi model Sistem Dinamis yang pada akhirnya digunakan sebagai dukungan untuk pengambilan keputusan pada satu atau lebih parameter sistem yang disimulasikan. Simulasi Sistem Dinamis menggabungkan konsep-konsep pemodelan Sistem Dinamis, komputasi, dan statistika. Penerapan Simulasi Sistem Dinamis dapat dijumpai antara lain pada rancangan model sistem dan proses pada bidang industri, ekonomi, biologi, keteknikan dan mingkungan, dll. Mata kuliah ini berisi topik-topik seperti Sistem Dinamis, membuat model Sistem Dinamis, model pertumbuhan populasi di alam, model ekologi sumber alam, model produksi dan inventori, model emisi CO2, model Quality Control, model penyebaran wabah epidemi, model pergerakan mekanis, model interaktif, kontrol Input Output, Analysis sensitivitas.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to explain the concept of Dynamic Systems, simulate Dynamic Systems, and find solutions. 2. Able to create a dynamic system simulation model from the description of the given problem. 3. Able to use dynamic system simulation model tools to execute dynamic system simulation models created. 4. Able to analyze the output of the dynamic system simulation model execution results. *1. Mahasiswa mampu menjelaskan konsep Sistem Dinamis, simulasi terhadap Sistem Dinamis, dan menemukan solusi.*

	2. Mahasiswa mampu membuat model simulasi Sistem Dinamis dari deskripsi masalah yang diberikan. *3. Mahasiswa mampu menggunakan kakas simulasi Sistem Dinamis untuk mengeksekusi model simulasi Sistem Dinamis yang dibuat.* *4. Mahasiswa mampu melakukan analisis luaran hasil eksekusi simulasi Sistem Dinamis.*
Content (*Materi Pembelajaran*)	1. Dynamic System concept, Dynamic System simulation. 2. Dynamic System simulation model from problem description. 3. Using Dynamic System simulation tools to execute the created Dynamic System simulation model. 4. Analyze the output of the Dynamic System simulation execution results. *1. Konsep Sistem Dinamis, simulasi Sistem Dinamis.* *2. Model simulasi Sistem Dinamis dari deskripsi masalah.* *3. Menggunakan kakas simulasi Sistem Dinamis untuk mengeksekusi model simulasi Sistem Dinamis yang dibuat.* *4. Analisis luaran hasil eksekusi simulasi Sistem Dinamis.*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Juan Martín García. System Dynamics: Modeling, Simulation and Analysis: Practical guide with

	examples for the design of industrial, economic, biological, engineering and environmental models. Kindle. 2022. 2. Joseph DiStefano III. DYNAMIC BIOSYTEM MODELING & SIMULATION METHODOLOGY: INTEGRATED & ACCESSIBLE - THIRD EDITION. Biomodeling Educator. 2023.… Supporting: 1. James L. Hargrove. Dynamic Modeling in the Health Sciences. Springer New York. 2014. 2. Bernard McGarvey, Bruce Hannon. Dynamic Modeling for Business Management: An Introduction. Springer New York. 2014.

Agent-based Simulation

Course (*Mata Kuliah*)	**Agent-based Simulation (*Simulasi Berbasis Agen*)**
Code (*Kode Mata Kuliah*)	EF234610
Semester	6
Lecturer (*Dosen Pengampu*)	Joko Lianto Buliali
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Simulation Modeling (*Pemodelan Simulasi*)
Course Description (*Deskripsi Mata Kuliah*)	Agent-based Simulation combines the concepts of Agent-based System modeling, computing, and statistics. The application of Agent-based Simulation can be found, among others, in the design of system and process models in the fields of industry, economics, biology, engineering and the environment, etc. This course contains topics such as agent concepts, defining model equations, simulating models, creating attributes, collections and aggregates, defining temporary parameters for simulation, importing initial data, consolidating imported data, creating new entities with actions and triggers, designing lots and cohorts of entities, Sensitivity Analysis, optimizing results, variable calibration, displaying results (in X-Y diagrams), Covid

	spread model, oil spill spread model, Traffic Light Model, Sales analysis model. *Simulasi Berbasis Agen menggabungkan konsep-konsep pemodelan Sistem Berbasis Agen, komputasi, dan statistika. Penerapan Simulasi Berbasis Agen dapat dijumpai antara lain pada rancangan model sistem dan proses pada bidang industri, ekonomi, biologi, keteknikan dan lingkungan, dll. Mata kuliah ini berisi topik-topik seperti konsep agen, mendefiniasikan persamaan model, mensimulasikan model, create attributes, collections dan aggregates, mendefinisikan temporary parameters untuk simulasi, mengimport initial data, mengkonsolidasi data import, create new entities dengan actions dan triggers, mendesain lots dan cohorts entities, Sensitivity Analysis, optimasi hasil, variable calibration, menampilkan hasil (dalam diagram X-Y), Model penyebaran Covid, Model penyebaran tumpahan minyak, Model Traffic Light, Model analisis penjualan.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the concept of Agent-Based Simulation, simulate Agent-Based Simulation, and find solutions with Agent-Based Simulation. 2. Students are able to create an Agent Based simulation model from the description of the given problem. 3. Able to create an agent based simulation model from the description of the given problem. 4. Students are able to use Agent Based simulation tools to execute the Agent Based simulation model created. 5. Able to use agent based simulation tools to execute agent based simulation models created. 6. Students are able to analyze the output of the Agent Based simulation execution results. 7. Able to analyze the output of the agent based simulation model execution results.

	1. *Mahasiswa mampu menjelaskan konsep Simulasi Berbasis Agen, simulasi Simulasi Berbasis Agen, dan menemukan solusi dengan Simulasi Berbasis Agen.* 2. *Mahasiswa mampu membuat model simulasi Berbasis Agen dari deskripsi masalah yang diberikan.* 3. *Able to create a agent based simulation model from the description of the given problem.* 4. *Mahasiswa mampu menggunakan kakas simulasi Berbasis Agen untuk mengeksekusi model simulasi Berbasis Agen yang dibuat.* 5. *Able to use agent based simulation tools to execute agent based simulation models created.* 6. *Mahasiswa mampu melakukan analisis luaran hasil eksekusi simulasi Berbasis Agen.* 7. *Able to analyze the output of the agent based simulation model execution results.*
Content (*Materi Pembelajaran*)	1. Agent Concept and Agent-based Simulation. 2. Agent-based simulation model of problem description. 3. Using Agent-Based simulation kakas to execute the created Agent-Based simulation model. 4. Analyze the output of the Agent-Based Simulation execution results. 1. *Konsep Agen dan Simulasi Berbasis Agen.* 2. *Model simulasi Berbasis Agen dari deskripsi masalah.* 3. *Menggunakan kakas simulasi Berbasis Agen untuk mengeksekusi model simulasi Berbasis Agen yang dibuat.* 4. *Analisis luaran hasil eksekusi Simulasi Berbasis Agen.*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal*

	2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Juan Martín García. System Dynamics: Modeling, Simulation and Analysis: Practical guide with examples for the design of industrial, economic, biological, engineering and environmental models. Kindle. 2022. 2. Joseph DiStefano III. DYNAMIC BIOSYTEM MODELING & SIMULATION METHODOLOGY: INTEGRATED & ACCESSIBLE - THIRD EDITION. Biomodeling Educator. 2023. Supporting: 1. Uri Wilensky, William Rand. An Introduction to Agent-Based Modeling: Modeling Natural, Social, and Engineered Complex Systems with NetLogo MIT Press. 2015.

Forecasting Techniques

Course (*Mata Kuliah*)	**Forecasting Techniques (*Teknik Peramalan*)**
Code (*Kode Mata Kuliah*)	EF234611
Semester	6
Lecturer (*Dosen Pengampu*)	1. Arya Yudhi Wijaya 2. Ahmad Saikhu 3. Bilqis Amaliah 4. Joko Lianto Buliali 5. Victor Hariadi
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The material in the Forecasting Techniques elective course teaches students to master the methods or processes used to predict the future of an event or event based on time series data using Box-Jenkins, Ensemble, Machine Learning, or Deep Learning methods with case studies of stocks, weather, population, etc. *Materi dalam MK Pilihan Teknik Peramalan mengajarkan mahasiswa untuk menguasai metode atau proses yang digunakan untuk memprediksi*

	masa depan dari suatu kejadian atau peristiwa berdasarkan data deret waktu menggunakan metode Box-Jenkins, Ensemble, Machine Learning, atau Deep Learning dengan studi kasus saham, cuaca, kependudukan, dll.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the concepts of forecasting, the basic stages of forecasting, and time series analysis 2. Students are able to design forecasts using methods: Box-Jenkins, Ensemble, Machine Learning, and Deep Learning. 3. Students are able to implement forecasting on case studies: stocks, weather, population, etc. using Excel, Python, or R 4. Students are able to analyze forecasting results and determine the best forecasting method *1. Mahasiswa mampu menjelaskan konsep peramalan, tahapan dasar peramalan, dan analisis deret waktu* *2. Mahasiswa mampu merancang peramalan menggunakan menggunakan metode: Box-Jenkins, Ensemble, Machine Learning, dan Deep Learning* *3. Mahasiswa mampu mengimplementasikan peramalan pada studi kasus: saham, cuaca, kependudukan, dll. dengan menggunakan Excel, Phyton, atau R* *4. Mahasiswa mampu menganilisis hasil peramalan dan menentukan metode peramalan terbaik*
Content (*Materi Pembelajaran*)	1. Forecasting concepts, basic stages of forecasting, and time series analysis 2. Forecasting using the Box-Jenkins method: ARIMA and SARIMA 3. Forecasting using Ensemble methods: Bagging, Boosting, Stacking, and Random Forest 4. Forecasting using Machine Learning methods: Artificial Neural Network and SVM 5. Forecasting using Deep Learning methods: CNN, RNN, LSTM, and GRU

	6. Forecasting Implementation using: Excel, Python, or R with case studies of stocks, weather, population, etc. *1. Konsep peramalan, tahapan dasar peramalan, dan analisis deret waktu* *2. Peramalan menggunakan metode Box-Jenkins: ARIMA dan SARIMA* *3. Peramalan menggunakan metode Ensemble: Bagging, Boosting, Stacking, dan Random Forest* *4. Peramalan menggunakan metode Machine Learning: Jaringan Syaraf Tiruan dan SVM* *5. Peramalan menggunakan metode Deep Learning: CNN, RNN, LSTM, dan GRU* *6. Implementasi Peramalan menggunakan: Excel, Phyton, atau R dengan studi kasus saham, cuaca, kependudukan, dll.*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Galith Shmueli, Kenneth C. Lichtendahl Jr., Practical Time Series Forecasting with R: A Hands-On Guide 2th edition, Axelrod Schnall Publishers, 2016 2. Richard A. Davis, Peter J. Brockwell., Introduction to Time Series and Forecasting 3th edition, Springer, 2016 3. Rob J. Handyman, George A., Forecasting Principles and Practice, 9th edition, Otexts, 2013 4. Hanke, John E., Wichern, Dean W., Business Forecasting 9th edition, Prentice Hall, 2008

	5. Makridakis, Spyros., Wheelwright, Steven C., Hyndman, Rob J. Forecasting: Methods and Applications 3rd edition, John Wiley & Sons, 2008 Supporting: 1. John E., Silvia, Sarah Watt, Kaylin S, et.al. Economic and Business Forecasting: Analyzing and Interpreting Economic Result. Wiley. 2014 2. Francis X. Diebold. Element of Forecasting. South-Western Thomson Learning, 2nd edition, 2000 3. Robert Yaffee, Monnie McGee. Intorduction to Time Series Analysis and Forecasting, with Application of SAS and SPSS. Academic Press Inc. 2000

Computer Animation and 3D Modeling

Course (*Mata Kuliah*)	**Computer Animation and 3D Modeling (*Animasi Komputer dan Pemodelan 3D*)**
Code (*Kode Mata Kuliah*)	EF234612
Semester	6
Lecturer (*Dosen Pengampu*)	Siska Arifiani
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Brief Description Computer Animation and 3D Modeling is an advanced computer graphics course that further studies 3D computer modeling and animation using Blender. *Animasi Komputer dan Permodelan 3D merupakan mata kuliah lanjutan grafika komputer yang mempelajari lebih lanjut tentang permodelan dan animasi 3D komputer dengan menggunakan kakas bantu Blender.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Understand the trends of technology development and research in computer animation and 3D modeling.

	2. Students are able to explain basic concepts in 3D modeling and animation 3. Students are able to use tools that can be used in simple 3D modeling 4. Students are able to use tools that can be used in simple 3D animation *1. Memahami tren perkembangan teknologi dan riset dalam animasi komputer dan permodelan 3D* *2. Mahasiswa mampu menjelaskan konsep dasar dalam permodelan dan animasi 3D* *3. Mahasiswa dapat menggunakan kakas bantu yang dapat digunakan dalam permodelan 3D sederhana* *4. Mahasiswa dapat menggunakan kakas bantu yang dapat digunakan dalam animasi 3D sederhana*
Content (*Materi Pembelajaran*)	1. Basic 3D modeling and animation 2. Basic modeling and animation with Blender *1. Dasar permodelan dan animasi 3D* *2. Dasar permodelan dan animasi dengan Blender*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. 3D Animation Essentials 2. 3D Art Essentials, The Fundamental of 3D Modeling and Animation Supporting: 1. Blender 3.4 Reference Manual

Educational and Simulation Game

Course (*Mata Kuliah*)	**Educational and Simulation Game (*Game Edukasi dan Simulasi*)**
Code (*Kode Mata Kuliah*)	EF234613
Semester	6
Lecturer (*Dosen Pengampu*)	Imam Kuswardayan
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The Educational and Simulation Games course is designed to provide knowledge, understanding of existing educational and simulation games and how to design and develop them. Students are expected to be able to add insight into educational games, be able to provide an assessment of educational games, design educational games, design simulations with finite state machines and then implement them in a simple game application. *Mata kuliah Game Edukasi dan Simulasi dirancang untuk memberikan pengetahuan, pemahaman tentang game edukasi dan simulasi yang ada serta bagaimana merancang dan mengembangkannya.*

	Mahasiswa diharapkan mampu menambah wawasan tentang game edukasi, mampu meberikan penilaian terhadap game edukasi, merancang game edukasi, merancang simulasi dengan finite state machine kemudian mengimplementasikannya pada sebuah aplikasi game sederhana.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to understand and provide reviews of educational games and their examples 2. Able to develop a simple educational game 3. Able to design simulation with finite state machine 4. Able to develop simulation games with simulation designs made previously *1. Mampu memahami dan memberikan ulasan tentang game edukasi dan contoh-contohnya* *2. Mampu mengembangkan sebuah game edukasi sederhana* *3. Mampu merancang simulasi dengan finite state machine* *4. Mampu mengembangkan game simulasi dengan rancangan simulasi yang dibuat sebelumnya*
Content (*Materi Pembelajaran*)	1. Insight into existing educational and simulation games 2. Educational game design and development 3. Simulation design with finite state machine 4. Design and development of simulation games *1. Wawasan game edukasi dan simulasi yang ada saat ini* *2. Perancangan dan pengembangkan game edukasi* *3. Perancangan simulasi dengan finite state machine* *4. Perancangan dan pengembangkan game simulasi*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam

	1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Educational Game Design Fundamentals: A Journey to Creating Intrinsically Motivating Learning Experiences; George Kalmpourtzis; A K PETERS;CRC Press; 2019 2. Educational Games for Soft-Skills Training in Digital Environments: New Perspectives, Elena Dell'Aquila Davide Marocco Michela Ponticorvo Andrea di Ferdinando Massimiliano Schembri Orazio Miglino; Springer International Publishing; 2015 Supporting: 1. Choosing and Using Digital Games in the Classroom: A Practical Guide [1 ed.]; Katrin Becker; Springer International Publishing; 2017

User Experience Design

Course (*Mata Kuliah*)	**User Experience Design (*Desain Pengalaman Pengguna*)**
Code (*Kode Mata Kuliah*)	EF234614
Semester	6
Lecturer (*Dosen Pengampu*)	Hadziq Fabroyir
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Interface design impacts the lifecycle of software. The design and implementation of key functions in a software affects the user interface. This course involves several cross-disciplines such as: psychology, ergonomics, anthropology, computer science, graphic and product design. Through this course, students are expected to be able to apply the principles of Human-Computer Interaction to software development as well as conduct a Usability Evaluation of software and report on it. *Desain antar muka berdampak pada daur hidup suatu perangkat lunak. Desain dan implementasi fungsi-fungsi pokok dalam suatu perangkat lunak*

	mempengaruhi antar muka pengguna. Mata kuliah ini melibatkan beberapa lintas disiplin ilmu seperti: psikologi, ergonomi, antropologi, ilmu komputer, desain grafis dan produk. Melalui mata kuliah ini mahasiswa diharapkan mampu menerapkan prinsip-prinsip Interaksi Manusia dan Komputer (Human-Computer Interaction) pada pembuatan perangkat lunak serta melakukan evaluasi ketepatgunaan (Usability Evaluation) perangkat lunak dan melaporkannya.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to discuss the importance of user-centered software development. 2. Students are able to develop and use the concepts of modeling, feedback to analyze the interaction between humans and software. 3. Students are able to define a user-centered design process that explicitly places the user rather than the builder. 4. Students are able to build simple applications along with instructions for use, as well as documentation that supports the user interface. 5. Students are able to create and conduct usability tests on software that has been developed, conduct quantitative evaluations (utility, efficiency, ease of use, and user satisfaction levels), and report them. *1. Mahasiswa mampu mendiskusikan pentingnya pengembangan perangkat lunak yang berpusat pada pengguna.* *2. Mahasiswa mampu mengembangkan dan menggunakan konsep permodelan, umpan balik untuk menganalisa interaksi antara manusia dengan perangkat lunak.* *3. Mahasiswa mampu mendefinisikan proses desain yang berfokus pada pengguna yang secara eksplisit menempatkan pengguna bukan sebagai pembangun.* *4. Mahasiswa mampu membangun aplikasi sederhana beserta petunjuk penggunaan, serta*

	dokumentasinya yang mendukung antar muka pengguna. 5. *Mahasiswa mampu membuat dan melakukan tes ketepatgunaan (Usability Test) pada perangkat lunak yang telah dikembangkan, melakukan evaluasi secra kuantitatif (utilitas, efisiensi, tingkat kemudahan penggunaan, dan tingkat kepuasan pengguna), dan melaporkannya.*
Content (*Materi Pembelajaran*)	1. Humans, Computers, and Interaction 2. Sensitivity to Good and Bad Design 3. Persona 4. User Interface and User Experience (UI/UX) 5. Natural-User Interface 6. Design Thinking 7. Contextual Inquiry and Analysis 8. Prototyping Using Figma 9. Usability Evaluation 10. Heuristic Analysis 1. *Manusia, Komputer, dan Interaksi* 2. *Kepekaan Terhadap Desain yang Bagus dan yang Jelek* 3. *Persona* 4. *Antarmuka Pengguna dan Pengalaman Pengguna (UI/UX)* 5. *Antarmuka Natural* 6. *Pemikiran Desain* 7. *Penyelidikan dan Analisis Kontekstual* 8. *Purwarupa* 9. *Evaluasi Ketepatgunaan* 10. *Analisis heuristis*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*

Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. The UX Book Process and Guidelines for Ensuring a Quality User Experience 2. Lean UX_ Creating Great Products with Agile Teams (2021) 3. Human Computer Interaction An Empirical Research Perspective

Audit System

Course (*Mata Kuliah*)	**Audit System (*Audit Sistem*)**
Code (*Kode Mata Kuliah*)	EF234615
Semester	6
Lecturer (*Dosen Pengampu*)	Riyanarto Sarno
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Database Management (*Manajemen Basis Data*)
Course Description (*Deskripsi Mata Kuliah*)	The Topic course in System Audit is designed to provide students with knowledge related to system auditing, from process design to making recommendations based on best practices. *Mata kuliah Audit Sistem dirancang untuk memberikan pengetahuan bagi mahasiswa berkaitan dengan audit sistem, mulai dari perancangan proses sampai pembuatan rekomendasi berdasarkan penerapan terbaik (best practice).*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the purpose of an information technology audit and identify process and information risks related to confidentiality, integrity and availability

	2. Students are able to design and carry out audit processes that are suitable for enterprise needs 3. Students are able to design and implement procedures and control measures to manage risk effectively 4. Students are able to make recommendations for improving system performance by referring to examples of best practices, standards and regulations for information technology governance *1. Mahasiswa mampu memahami tujuan audit teknologi informasi dan mengidentifikasi risiko proses dan informasi yang berkaitan dengan kerahasiaan, integritas dan ketersediaan* *2. Mahasiswa mampu merancang dan melaksanakan proses audit yang sesuai keperluan enterprise* *3. Mahasiswa mampu merancang dan mengimplementasi prosedur dan pengukuran kontrol untuk mengelola risiko secara efektif* *4. Mahasiswa mampu membuat rekomendasi untuk peningkatan kinerja sistem dengan mengacu pada contoh penerapan terbaik (best practice), standard dan peraturan tata kelola teknologi informasi*
Content (*Materi Pembelajaran*)	1. Information Systems / Information Technology governance concept 2. Governance framework 3. Control objectives 4. System audit planning 5. Business process audit 6. Audit implementation and evaluation 7. Audit reporting and recommendations *1. Konsep tata kelola Sistem Informasi / Teknologi Informasi* *2. Framework tata kelola* *3. Control objectives* *4. Perencanaan audit sistem*

	5. Audit proses bisnis *6. Pelaksanaan dan evaluasi audit* *7. Pelaporan dan rekomendasi audit*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Riyanarto Sarno, Audit Sistem Informasi/Teknologi Informasi, ITS Press, 2009. 2. Riyanarto Sarno, Strategi Sukses Bisnis dengan Teknologi Informasi Berbasis Balanced Scorecard dan COBIT, ITS Press, 2009, ISBN 978-979-8897-42-9. 3. ISO/IEC 38500:2008 Corporate Governance of Information Technology 4. Sandra Senft, Frederick Gallegos, Daniel P. Manson, Carol Gonzales. Information Technology Control and Audit Second Edition. CRC Press, 2009. ISBN 978-0849320323 5. Davis, M. Schiller, & K. Wheeler. IT auditing: using controls to protect information assets. New York: McGraw-Hill. 2007 Supporting: 1. Simha R. Magal, Integrated Business Processes with ERP Systems, John Wiley & Sons, Inc., 2014. 2. Riyanarto Sarno & Irsyat Iffano, Sistem Manajemen Keamanan Informasi, ITS Press, 2009.

Distributed Databases

Course (*Mata Kuliah*)	**Distributed Databases (*Basis Data Terdistribusi*)**
Code (*Kode Mata Kuliah*)	EF234616
Semester	6
Lecturer (*Dosen Pengampu*)	Abdul Munif
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Brief Description of the course In this lecture, the design of distributed database architecture and the main concepts in distributed databases are discussed. By understanding these things, students are able to apply them to create database systems with reliable availability and reliability. Students are also expected to understand current issues in distributed databases and apply solutions to these issues. *Dalam perkuliahan ini dibahas desain arsitektur basis data terdistribusi serta konsep-konsep utama dalam basis data terdistribusi. Dengan memahami hal-hal tersebut, mahasiswa mampu menerapkannya untuk membuat sistem basis data dengan availabilitas dan reliabilitas yang handal. Mahasiswa juga diharapkan*

	memahami isu-isu terkini dalam basis data terdistribusi serta menerapkan solusi untuk isu-isu tersebut.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students understand and are able to apply distributed database architecture design 2. Students understand the main concepts in distributed databases 3. Students understand and be able to apply distributed database availability and reliability 4. Students understand and be able to apply solutions to current issues in distributed databases. 1. *Mahasiswa memahami dan mampu menerapkan desain arsitektur basis data terdistribusi* 2. *Mahasiswa memahami konsep-konsep utama dalam basis data terdistribusi* 3. *Mahasiswa memahami dan mampu menerapkan availabilitas dan reliabilitas basis data terdistribusi* 4. *Mahasiswa memahami dan mampu menerapkan solusi untuk isu-isu terkini dalam basis data terdistribusi*
Content (*Materi Pembelajaran*)	1. Database System Review and Introduction to Distributed Database 2. Parallel and distributed database system design 3. Distributed data control 4. Distributed query processing 5. Distributed transaction processing 6. Data Replication 7. Database integration - multidatabase systems 8. Parallel database system 9. Peer-to-peer data management 10. NoSQL 11. NewSQL 12. Polystores 13. Web Data Management 1. *Review Sistem Basis Data dan Pengantar Basis Data Terdistribusi*

	2. Desain sistem basis data paralel dan terdistribusi *3. Kontrol data terdistribusi* *4. Pemrosesan query terdistribusi* *5. Pemrosesan transaksi terdistribusi* *6. Replikasi Data* *7. Integrasi basis data - sistem multidatabase* *8. Sistem basis data paralel* *9. Manajemen data peer-to-peer* *10. NoSQL* *11. NewSQL* *12. Polystores* *13. Web Data Management*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Ozsu, M. T., & Valduriez, P. (2020). Principles of Distributed Database (Fourth Edition). Springer. Supporting: 1. Krogh, J. W. (2021). MySQL Concurrency. Apress Media LLC. 2. Krogh, J. W., & Okuno, M. (2017). Pro MySQL NDB Cluster. Apress Media, LLC. 3. Schwartz, B., Zaitsev, P., & Tkachenko, V. (2012). High Performance MySQL (Third Edition). O'Reilly Media, Inc.

Geographic Information System

Course (*Mata Kuliah*)	**Geographic Information System (*Sistem Informasi Geografis*)**
Code (*Kode Mata Kuliah*)	EF234617
Semester	6
Lecturer (*Dosen Pengampu*)	Hari Ginardi
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	In this course, students will learn the different concepts between geographic information systems and other information systems. Students will analyze spatial-temporal data, 3-D surface analysis, map coordinate systems and projection systems. In addition, students develop theme maps from gps tracking according to the latest approaches. *Pada mata kuliah ini mahasiswa akan mempelajari konsep yang berbeda antara sistem informasi geografis dengan sistem informasi lainnya. Siswa akan menganalisis data spasial-temporal, analisis permukaan 3-D, sistem koordinat peta dan sistem proyeksi. Selain itu, siswa mengembangkan peta*

	tema dari pelacakan gps sesuai dengan pendekatan terbaru.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to use industry standard Geographic Information System (GIS) software and open source software 2. Students are able to make innovations according to current needs such as community-based-mapping, location-based-services, mobile-GIS *1. Mahasiswa mampu menggunakan perangkat lunak Sistem Informasi Geografis (SIG) standar industri dan perangkat lunak sumber terbuka* *2. Mahasiswa mampu membuat inovasi sesuai kebutuhan terkini seperti community-based-mapping, location-based-services, mobile-GIS*
Content (*Materi Pembelajaran*)	1. Map Projection and Coordinate System 2. Map digitizing 3. GPS 4. Remote Sensing - Thematic Map 5. Spatial Analysis 6. 3-D Analysis 7. Community-Based Mapping 8. Location-based Services *1. Proyeksi Peta dan Sistem Koordinat* *2. Digitalisasi peta* *3. GPS* *4. Penginderaan Jauh - Peta Tematik* *5. Analisis Spasial* *6. Analisis 3-D* *7. Pemetaan Berbasis Komunitas* *8. Layanan Berbasis Lokasi*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis*

	3. Evaluasi Tengah Semester *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Longley, P.A., Goodchild, M.F., Maguire, D.J., and Rhind, D.W., 2011, Geographic Information Systems and Science, New York, John Wiley & Sons. 2. Narayan Panigrahi, Computing in Geographic Information System, CRC Press, 2014 Supporting: 1. Quantum GIS, online resources (www.qgis.org) 2. OpenStreetMap, online resources 3. Google Map API, online resources

Game Engine

Course (*Mata Kuliah*)	**Game Engine (*Game Engine*)**
Code (*Kode Mata Kuliah*)	EF234618
Semester	6
Lecturer (*Dosen Pengampu*)	Imam Kuswardayan
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The game engine course is a course that learns about the stages of the process in game development which includes the introduction of interfaces and navigation, debugging concepts, problem-solving, and API interpretation in games developed with game engines. *Mata kuliah game engine merupakan mata kuliah yang mempelajari tentang tahapan proses dalam pengembangan game yang meliputi pengenalan antarmuka dan navigasi, konsep debugging, problem-solving, dan interpretasi API pada game yang dikembangkan dengan game engine.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Understand game engine interface and navigation 2. Apply the concepts of debugging, problem-solving, and API interpretation to games developed with game engines 3. Understand the concept of code evaluation in game engines 4. Able to develop 2D and 3D games with game engines on specific development platforms 1. *Memahami antarmuka dan navigasi game engine* 2. *Menerapkan konsep debugging, problem-solving, dan interpretasi API pada game yang dikembangkan dengan game engine* 3. *Memahami konsep evaluasi kode pada game engine* 4. *Mampu mengembangkan game 2D dan 3D dengan game engine pada platform pengembangan tertentu*
Content (*Materi Pembelajaran*)	1. Introduction to game engine interface and navigation 2. Concepts of debugging, problem-solving, and API interpretation in games developed with game engines 3. Code evaluation 4. Able to develop 2D and 3D games with game engines on specific development platforms 1. *Pengenalan antarmuka dan navigasi game engine* 2. *Konsep debugging, problem-solving, dan interpretasi API pada game yang dikembangkan dengan game engine* 3. *Evaluasi kode* 4. *Mampu mengembangkan game 2D dan 3D dengan game engine pada platform pengembangan tertentu*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest

	4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. The Art of Game Design: A Book of Lenses, Third Edition 3rd 2. Foundations of Game Engine Development Supporting: 1. Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C# 3rd Edition 2. https://learn.unity.com/pathway/junior-programmer

Deep Learning

Course (*Mata Kuliah*)	**Deep Learning (*Deep Learning*)**
Code (*Kode Mata Kuliah*)	EF234619
Semester	6
Lecturer (*Dosen Pengampu*)	Siti Rochimah
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Machine Learning (*Pembelajaran Mesin*)
Course Description (*Deskripsi Mata Kuliah*)	Pada kuliah ini mahasiswa akan mempelajari teori, prinsip dan teknik deep learning dan menerapkannya pada penyelesaian permasalahan riil yang mencakup pembelajaran deep sequence model, deep computer vision model, deep generative model maupun deep reinforcement model. Mahasiswa juga mempelajari bagaimana penerapan model deep learning pada berbagai data dan aplikasi, seperti analisis sentimen, automatic essay answering, klasifikasi citra, deteksi obyek, generate teks dari data citra, generate citra sintetis, dsb. *In this course, students will learn the theory, principles and techniques of deep learning and apply them to solve real problems that include deep sequence*

	learning model, deep computer vision model, deep generative model and deep reinforcement model. Students also learn how to apply deep learning models to various data and applications, such as sentiment analysis, automatic essay answering, image classification, object detection, text generation from image data, synthetic image generation, etc.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the concept of artificial neural network and deep learning and its use in an application 2. Students are able to explain the concept of recurrent neural network architecture and its use in sequential data 3. Students are able to explain the concept of convolutional neural network architecture and its use in image data 4. Students are able to explain the concept of deep generative model and its use in synthetic data generation problems 5. Students are able to explain the concept of deep reinforcement learning and its use in game and robot applications *1. Mahasiswa mampu menjelaskan konsep artificial neural network dan deep learning serta penggunaannya pada suatu aplikasi* *2. Mahasiswa mampu menjelaskan konsep arsitektur reccurent neural network serta penggunaannya pada sequential data* *3. Mahasiswa mampu menjelaskan konsep arsitektur convolutional neural network serta penggunaanya pada data citra* *4. Mahasiswa mampu menjelaskan konsep deep generative model serta penggunaannya pada permasalahan pembangkitan data sintetis* *5. Mahasiswa mampu menjelaskan konsep deep reinforcement learning serta penggunaannya pada aplikasi game dan robot*
Content (*Materi Pembelajaran*)	1. Konsep Jaringan Syaraf Tiruan dan Deep learning 2. Arsitektur Jaringan Syaraf Tiruan

	3. Arsitektur Jaringan Syaraf Tiruan Convolutional 4. Model Generatif Dalam 5. Model Pembelajaran Penguatan Dalam (Deep Reinforcement Learning) *1. Konsep Artificial Neural Network dan Deep learning* *2. Arsitektur Reccurrent Neural Network* *3. Arsitektur Convolutional Neural Network* *4. Deep Generative Model* *5. Deep Reinforcement Learning Model*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. C. Y. Laporte, A. April, Software Quality Assurance, Wiley-IEEE Press, 2018. 2. Stephan Goericke, The Future of Software Quality Assurance, Springer Open, 2020. Supporting: 1. S. Naik dan P. Tripathy, Software Testing and Quality Assurance: Theory and Practice, Wiley-Spektrum, 2008. 2. G. Gordon Schulmeyer, Handbook of Software Quality Assurance, 4th Edition, Artech House London, 2008. 3. D. Galin, Software Quality Assurance: From Theory to Implementation, Pearson Education Limited, 2004.

Software Construction

Course (*Mata Kuliah*)	**Software Construction (*Konstruksi Perangkat Lunak*)**
Code (*Kode Mata Kuliah*)	ER234402
Semester	6
Lecturer (*Dosen Pengampu*)	Rizky Januar Akbar
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Machine Learning (*Pembelajaran Mesin*)
Course Description (*Deskripsi Mata Kuliah*)	This course discusses the principles and techniques used in the software construction phase which consists of design, construction, testing, and configuration aspects. Students will apply the principles of good software design into program code, write maintainable program code using clean code techniques, develop secure programs using defensive programming techniques, verify software by applying unit testing. In addition, students will be able to collaborate effectively with team members using appropriate techniques and tools. *Mata kuliah ini membahas tentang prinsip-prinsip dan teknik yang digunakan dalam fase konstruksi*

	perangkat lunak yang terdiri dari aspek desain, konstruksi, testing, dan konfigurasi. Mahasiswa akan menerapkan prinsip-prinsip desain perangkat lunak yang baik ke dalam kode program, menuliskan kode program yang mudah dirawat dengan teknik clean code, mengembangkan program yang aman menggunakan teknik defensive programming, melakukan verifikasi perangkat lunak dengan menerapkan unit testing. Selain itu, mahasiswa dapat melakukan kolaborasi antar anggota tim dengan efektif menggunakan teknik dan kakas-kakas yang sesuai.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students will be able to explain basic concepts and scope of software construction. 2. Students will be able to apply software design principles into program code. 3. Students will be able to apply best practices for code writing 4. Students will be able to use tools and techniques for collaborating effectively in a software development team. 1. *Mahasiswa mampu menjelaskan konsep dasar dan ruang lingkup konstruksi perangkat lunak* 2. *Mahasiswa mampu menerapkan prinsip-prinsip desain perangkat lunak ke dalam kode program.* 3. *Mahasiswa mampu menerapkan praktik penulisan kode sumber yang baik.* 4. *Mahasiswa mampu menggunakan kakas dan teknik untuk berkolaborasi di dalam sebuah tim pengembangan perangkat lunak secara efektif.*
Content (*Materi Pembelajaran*)	1. Basic concepts and scope of software construction in the software development lifecycle 2. Application of SOLID principles in program code 3. Clean code techniques 4. Defensive programming techniques 5. Unit testing techniques 6. Collaboration using Git 7. Code review technique

	1. *Konsep dasar dan ruang lingkup konstruksi perangkat lunak di dalam siklus pengembangan perangkat lunak* 2. *Penerapan SOLID principles di dalam kode program* 3. *Teknik clean code* 4. *Teknik defensive programming* 5. *Teknik unit testing* 6. *Kolaborasi menggunakan Git* 7. *Teknik code review*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. McConnell, Steve. "Code Complete: A Practical Handbook of Software Construction, Second Edition". Microsoft Press, 2004. 2. Martin, Robert C. "Clean Code: A Handbook of Agile Software Craftsmanship". Prentice Hall, 2008. 3. Carullo, Giuliana. "Implementing Effective Code Reviews". Apress, 2022. 4. Stellman, Andrew and Greene, Jennifer. "Learning Test-Driven Development". O'Reilly Media, Inc., 2020. 5. IEEE Computer Society. (2014). Guide to the Software Engineering Body of Knowledge (SWEBOK® Guide), Version 3.0. Hoboken, NJ: John Wiley & Sons. 6. Ponuthorai, P. K., & Loeliger, J. (2022). Version Control with Git: Powerful Tools and Techniques

	for Collaborative Software Development (3rd ed.). Sebastopol, CA: O'Reilly Media, Inc. Supporting: 1. Graff, Mark G. and van Wyk, Kenneth R. "Secure Coding: Principles and Practices". O'Reilly Media, 2003.

Software Quality

Course (*Mata Kuliah*)	**Software Quality (*Kualitas Perangkat Lunak*)**
Code (*Kode Mata Kuliah*)	ER234503
Semester	6
Lecturer (*Dosen Pengampu*)	Siti Rochimah
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (Tatap muka): 3x50'/week 2. Exercises and Assignments (Latihan dan Tugas): 3x60'/week 3. Private Learning (Belajar mandiri): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.*
Mandatory prerequisites (*Mata kuliah prasyarat*)	Machine Learning (*Pembelajaran Mesin*)
Course Description (*Deskripsi Mata Kuliah*)	This course contains activities that ensure that all software engineering processes, methods, activities, and work items are monitored and conform to established standards. To achieve software quality, it is necessary to incorporate all software development processes from determining software requirements, programming, testing, to release. *Mata kuliah ini berisi kegiatan yang memastikan bahwa semua proses, metode, aktivitas, dan item pekerjaan rekayasa perangkat lunak dipantau dan sesuai dengan standar yang ditetapkan. Untuk mencapai kualitas*

	perangkat lunak, perlu dilakukan penggabungan semua proses pengembangan perangkat lunak mulai dari menentukan kebutuhan perangkat lunak, pemrograman, pengujian, hingga rilis.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the basics of software quality, understand the culture of software quality, define software quality requirements, and describe software quality models. 2. Students are able to carry out the software review process and conduct software audits. 3. Students are able to carry out software verification and validation processes, and measure software quality using certain standards. 4. Students are able to identify and describe software risk management based on certain standards, and compile software quality assurance plan documents. *1. Mahasiswa mampu memahami dasar-dasar kualitas perangkat lunak, memahami kultur kualitas perangkat lunak, mendefinisikan kebutuhan kualitas perangkat lunak, dan menjabarkan model-model kualitas perangkat lunak.* *2. Mahasiswa mampu melakukan proses review perangkat lunak dan melakukan audit perangkat lunak.* *3. Mahasiswa mampu melakukan proses verifikasi dan validasi perangkat lunak, serta melakukan pengukuran kualitas perangkat lunak menggunakan standar tertentu.* *4. Mahasiswa mampu mengidentifikasi dan menjabarkan manajemen risiko perangkat lunak berdasarkan standar tertentu, dan menyusun dokumen rencana penjaminan kualitas perangkat lunak.*

Content (*Materi Pembelajaran*)	1. Fundamentals of software quality 2. Software quality culture 3. Software quality requirements 4. Software quality models and standards 5. Software review process 6. Software auditing 7. Software verification and validation 8. Software quality measurement 9. Software risk management 10. Software quality assurance plan *1. Dasar-dasar kualitas perangkat lunak* *2. Kultur kualitas perangkat lunak* *3. Kebutuhan kualitas perangkat lunak* *4. Model dan standar kualitas perangkat lunak* *5. Proses review perangkat lunak* *6. Audit perangkat lunak* *7. Verifikasi dan validasi perangkat lunak* *8. Pengukuran kualitas perangkat lunak* *9. Manajemen risiko perangkat lunak* *10. Rencana penjaminan kualitas perangkat*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. C. Y. Laporte, A. April, Software Quality Assurance, Wiley-IEEE Press, 2018. 2. Stephan Goericke, The Future of Software Quality Assurance, Springer Open, 2020.

	Supporting: 1. S. Naik dan P. Tripathy, Software Testing and Quality Assurance: Theory and Practice, Wiley-Spektrum, 2008. 2. G. Gordon Schulmeyer, Handbook of Software Quality Assurance, 4th Edition, Artech House London, 2008. 3. D. Galin, Software Quality Assurance: From Theory to Implementation, Pearson Education Limited, 2004.

Semester 7

Indonesia Language

Course (*Mata Kuliah*)	**Indonesia Language (*Bahasa Indonesia*)**
Code (*Kode Mata Kuliah*)	UG224912
Semester	7
Lecturer (*Dosen Pengampu*)	Tim Dosen Pancasila ITS
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The Indonesian language course is one of the general / national compulsory courses, therefore students will explore lecture materials including: (a) academic ethics; (b) referencing techniques; (c) Systematicsof Scientific Writing (KTI) and Indonesian language formulations used in KTI with due observance ofgrammar, PUEBI, and KBBI principles; (d) structuring KTI logically, critically, systematically, and innovatively by using good and correct Indonesian; (e) effective presentation techniques. The material studied is useful in compiling scientific papers in the form of lecture assignments, researchreports, as well as competed scientific papers. Mata kuliah bahasa Indonesia termasuk salah satu mata kuliah wajib umum/nasional, oleh karena itu mahasiswa akan mendalami materi perkuliahan meliputi: (a) etika akademik; (b) teknik pereferensian; (c) sistematika KTI

	dan formulasi bahasa Indonesia yang digunakan dalam KTI dengan memperhatikan kaidah gramatika, PUEBI, dan KBBI; (d) penyusunan KTI secara logis, kritis, sistematis, dan inovatif dengan menggunakan bahasa Indonesia yang baik dan benar; (e) teknik presentasi efektif.. Materi yang dipelajari bermanfaat dalam menyusun karya tulis ilmiah baik berupa tugas perkuliahan, laporan penelitian, maupun karya tulis ilmiah yang dikompetisikan
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to explain concepts and benefits of understanding the application of academic ethics correctly 2. Able to apply reference and citation techniques appropriately 3. Able to explain the systematics and formulations of Indonesian used in KTI by payingattention to the rules of grammar, PUEBI, and KBBI 4. Able to compile KTI in the title and introduction well as a form of logical, critical, systematic, and innovative logical thinking ability using good and correct Indonesian 5. Able to apply logical, critical, systematic, and innovative thinking in the compilation of the KTI results and discussion sections using good and correct Indonesian 6. Able to compile KTI conclusion and abstract parts well as a form of logical, critical, systematic, and innovative logical thinking ability using good and correct Indonesian 7. Able to present the results of the preparation of KTI properly according to the principles of effective communication *1. Mahasiswa mampu menjelaskan konsep dan manfaat memahami penerapan etika akademik dengan benar dalam menyusun KTI*

	2. *Mahasiswa mampu mengaplikasikan teknik pereferensian dan kutipan dengan tepat.* 3. *Mahasiswa mampu menjelaskan dan/atau memberikan contoh sistematika, formulasi bahasa Indonesia yang digunakan dalam* 4. *Mahasiswa mampu menyusun KTI bagian judul dan pendahuluan dengan baik sebagai wujud kemampuan berfikir logis, kritis, sistematis, dan inovatif menggunakan bahasa Indonesia yang baik dan benar* 5. *Mahasiswa mampu menyusun KTI bagian hasil dan pembahasan dengan baik sebagai wujud kemampuan berfikir logis, kritis, sistematis, dan inovatif menggunakan bahasa Indonesia yang baik dan benar.* 6. *Mahasiswa mampu menyusun KTI bagian kesimpulan dan abstrak dengan baik sebagai wujud kemampuan berfikir logis, kritis, sistematis, dan inovatif menggunakan bahasa Indonesia yang baik dan benar* 7. *Mahasiswa mampu mempresentasikan hasil penyusunan KTI dengan baik sesuai prinsip komunikasi efektif.*
Content (*Materi Pembelajaran*)	• Academic writing of scientific papers. • Reference techniques and Mendeley applications for reference systems. • Systematics, writing style, and grammatical rules for the Indonesian language in KTI.Effective presentation • Etika akademik. • Teknik pereferensian. • Sistematika, gaya selingkung, dan kaidah gramatika bahasa Indonesia dalam KTI. • Presentasi efektif
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam

	1. Latihan soal *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Alwi, Hasan, 2007, Tata Bahasa Baku Bahasa Indonesia, Edisi Ketiga, Balai Pustaka: Jakarta. 2. Dirjen Pembelajaran dan Kemahasiswaan Kemenristekdikti, Bahasa Indonesia untuk Perguruan Tinggi, 2016, Jakarta, Dirjen Belmawa. 3. Kamus Besar Bahasa Indonesia (daring atau luring), Kemdikbud RI, https://kbbi.kemdikbud.go.id/ 4. Pedoman Umum Ejaan Bahasa Indonesia (PUEBI), 2016 Supporting (*Pendukung*): 1. Pratapa, Suminar, 2018, Etika ilmiah, Hak cipta, dan Plagiarisme. 2. Rosmawaty, 2017, Menulis Karya Ilmiah, 2017. 3. The Structure, Format, Content, and Style of a Journal-Style Scientific Paper, Bates Collage,

Pancasila

Course (*Mata Kuliah*)	**Pancasila (*Pancasila*)**
Code (*Kode Mata Kuliah*)	UG234911
Semester	7
Lecturer (*Dosen Pengampu*)	• Tim Dosen Pancasila ITS
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 2x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 2x60'/week 3. Private Learning (*Belajar mandiri*): 2x60'/week 4. Practice (*Praktikum)*
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Character is the primary pillar in the development of a nation's civilization. In this development effort, efforts are required to establish Pancasila's essential ideals as the philosophy and way of life of the Indonesian people. In this course, students will be invited to investigate and comprehend the Indonesian nation's identity using Pancasila content from the country's recent past. Then, recognise Pancasila's strategic functions as a noble agreement, the foundation of the state, philosophy and ideology of the nation, and finally, implement Pancasila in the growth of science and technology. Case studies, group discussions, and project-based learning will all be employed as teaching strategies in this course. Students will be encouraged to investigate topics provided in

	journals, on the internet, or in movies in order to develop their critical thinking and discussion skills. At the conclusion of the meeting, students must demonstrate their ability to work in groups by creating a final project based on the assigned theme. In order to create a sense of nationalism and be able to actively participate in development initiatives in the fields of science and technology, students are anticipated to be able to get a basic understanding of the fundamental philosophy of the Indonesian people through this course. *Karakter merupakan tonggak utama dalam membangun peradaban sebuah bangsa. Dalam usaha pembangunan tersebut maka dibutuhkan upaya penanaman nilai-nilai dasar Pancasila sebagai falsafah dan pandangan hidup manusia Indonesia. Pada mata kuliah ini peserta didik akan diajak untuk menyelami dan memahami jatidiri Bangsa Indonesia melalui materi Pancasila dalam arus sejarah bangsa. Kemudian dilanjutkan dengan mengenali peran-peran strategis Pancasila sebagai perjanjian luhur, dasar negara, filsafat, dan ideologi bangsa, dan yang terakhir adalah implementasi Pancasila dalam pengembangan sains dan teknologi. Metode belajar yang akan dipakai dalam mata kuliah ini adalah studi kasus, diskusi, dan project based learning. Mahasiswa akan diajak untuk belajar berpikir kritis dan berdiskusi melalui kajian persoalan yang disajikan melalui tayangan film, internet, ataupun jurnal. Pada akhir pertemuan, mahasiswa dituntut untuk dapat bekerja kelompok dengan membuat proyek tugas akhir berdasarkan tema yang telah disediakan. Melalui mata kuliah ini, maka mahasiswa diharapkan mampu memperoleh pemahaman yang mendasar tentang dasar filsafat bangsa Indonesia, sehingga mereka memiliki spirit nasionalisme dan mampu berperan serta aktif dalam usaha pembagunan di bidang sains dan teknologi.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to study the values of Pancasila in its application in the life of the nation and state 2. Able to understand the implementation of Pancasila as a basic philosophy and outlook on life as a reference for the attitude of life as a nation and state 3. Able to analyze the development of science and technology in the era of the Industrial Revolution 4.0 based on Pancasila values 4. Able to practice social sensitivity, environmental care and love for the homeland *1. Mampu mengkaji nilai-nilai Pancasila dalam penerapannya di dalam kehidupan berbangsa dan bernegara* *2. Mampu menghayati implementasi Pancasila sebagai dasar filsafat dan pandangan hidup sebagai acuan sikap hidup berbangsa dan bernegara* *3. Mampu menganalisis pengembangan sains dan teknologi di era Revolusi Industri 4.0 berbasis nilai-nilai Pancasila* *4. Mampu mempraktekkan kepekaan sosial, kepedulian lingkungan dan cinta tanah air*
Content (*Materi Pembelajaran*)	• The urgency of Pancasila in higher education • The history of Pacnasila • Pancasila as the Indonesia national principle and national ideology • Pancasila as philosophy system • Pancasila as ethic system • Pancasila as the foundation of science, technology and art development • *Urgensi Pendidikan Pancasila di Indonesia* • *Pancasila dalam Arus Sejarah Bangsa Indonesia* • *Pancasila sebagai Dasar Negara Republik Indonesia* • *Pancasila sebagai Filsafat dan Ideologi negara* • *Pancasila sebagai Sistem Etika*

	• *Pancasila sebagai Nilai Dasar Pengembangan Sains dan Teknologi di Indonesia*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Kemenristekdikti. 2016. Pendidikan Pancasila Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kementerian Dikti Supporting (*Pendukung*): 1. Bahar, Saafroedin (ed). 1992. Risalah Sidang Badan Penyelidik Usaha-Usaha Persiapan Kemerdekaan Indonesia (BPUPKI): 2. Panitia Persiapan Kemerdekaan Indonesia (PPKI) 29 Mei – 19 Agustus 1945. Jakarta: Sekretariat Negara Republik Indonesia. Bertens, Kees. 2004. Etika. Jakarta: Gramedia. 3. Kattsof, Louis O. 1992. Pengantar Filsafat. Yogyakarta: Tiara Wacana. 4. Latif, Yudi. 2011. Negara Paripurna, Jakarta: PT. Gramedia Pustaka Utama. 5. Latif, Yudi. 2018. Wawasan Pancasila: Bintang Penuntun Untuk Pembudayaan. Jakarta: Mizan. 6. Magnis-Suseno, Franz. 2006. Etika Politik: Prinsip-prinsip Moral Dasar Kenegaraan Modern. Jakarta: Penerbit Gramedia Pustaka Utama. 7. Sukarno. 2001. Tjamkan Pancasila Dasar Falsafah Negara. Jakarta: Panitia Nasional Peringatan Lahirnya Pancasila 1 Juni 1945 –1 Juni 1964.

	8. Soedarso. 2014. Filsafat Pancasila Identitas Indonesia. Surabaya: Pustaka Radja.

Applied Technology and Digital Transformation

Course (*Mata Kuliah*)	**Applied Technology and Digital Transformation (*Aplikasi Teknologi dan Transformasi Digital*)**
Code (*Kode Mata Kuliah*)	UG234916
Semester	7
Lecturer (*Dosen Pengampu*)	• Dra. Sukriyah Kustanti Moerad.MSi. • Dra, Endang Susilowati, M.Kes. • Deti Rahmawati, S.IP. M.T • Lienggar Rahardiantino, SE.,M.Sc. • Dr. Tridani Widyastuty, MSi.MT • Yudha Prasetyawan, ST. M.Eng. • Gogor Arif Handiwibowo, ST.,MMT • Lissa Rosdianna ST.,MT • Zjahra Vianita Nugraheni, SSi.,MSi. • Dr.Ir. Hasan Ikhwani, MSc. • Dyah Savitri, ST.,MT • Dr. Irhamah SSi., MSi. • Dr. Atria Pradityana, ST. MT. • Ir.Nur Laili, MT.Ph.D • Ciptian Weried P, SST.,MT. • Ir. Joko Susilo, MT • Muhammad Hafiizh Imaaduddiin, MT.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*

Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Technology Application and Digital Transformation (APTEKTRANSIDI) is one of the compulsory courses. This course is a hallmark of ITS, which will inspire students in developing insights into science, technology and innovation products that are competitive and form its application in society and the environment. Students will receive the following materials: 1) Knowledge and Concepts Digital Literacy; 2) Systems Theory and Systemic Thinking; 3) Introduction to Artificial Intelligence and Technology Science Technopark (STP); 4) Knowledge of National Research Roadmap and ITS; 5) Knowledge and Concept of Sustainable Development Goals (SDGs); 6) Creative and Innovative Knowledge; 7) Opensource technology of mobile applications, e comerce; and 8) Making Student Creativity Program (PKM) Proposals and similar programs in preparing project-based innovations along with PKM Proposal Outputs (Articles and Videos). At the end of the lecture, students are able to compile a Student Creativity Program (PKM) Proposal based on the knowledge that has been given in this lecture. The benefits of learning the APTEKTRANSIDI Course are: Students are able to explain, explain and implement problems in society and the environment with a Technology Application approach and expertise in their fields in accordance with the principles in the teaching material APTEKTRANSIDI. . *Mata Kuliah Aplikasi Teknologi dan Transformasi Digital (APTEKTRANSIDI) merupakan salah satu mata kuliah muatan Institut yang wajib diambil. Mata kuliah ini merupakan penciri ITS, yang akan memberikan inspirasi kepada mahasiswa dalam mengembangkan wawasan*

	ilmu pengetahuan, teknologi dan produk inovasi yang berdaya saing serta bentuk aplikasinya di masyarakat dan lingkungan. Mahasiswa akan menerima materi : *1) Pengetahuan dan Konsep* *Literasi Digital;* *2) Teori Sistem dan Berpikir Sistemik;* *3) Pengantar Artificial Intelligence dan Teknologi Science Technopark (STP);* *4) Pengetahuan Roadmap Riset Nasional dan ITS ;* *5) Pengetahuan dan Konsep Sustainable Development Goals (SDGs);* *6) Pengetahuan Kreatif dan Inovatif;* *7) Teknologi Opensource Aplikasi Mobile, E Comerce; serta* *8) Pembuatan Proposal Program Kreativitas Mahasiswa (PKM) dan program sejenis dalam menyiapkan project based inovasi beserta Luaran Proposal PKM (Artikel dan Video).* *Pada Akhir perkuliahan Mahasiswa mampu menyusun Proposal Program Kreatifitas Mahasiswa (PKM) berdasarkan pengetahuan yang sudah diberikan pada perkuliahan ini. Adapun Manfaat dari pembelajaran Mata Kuliah APTEKTRANSIDI adalah : Mahasiswa mampu menjelaskan, menerangkan dan mengimplementasikan persoalan-persoalan di masyarakat dan lingkungan dengan pendekatan Aplikasi Teknologi serta keahlian di bidang nya sesuai dengan prinsip di dalam materi ajar APTEKTRANSIDI.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students understand the outline of lectures from beginning to end, are able to understand the Knowledge and Concepts of Digital Literacy by thinking systematically in solving general problems properly and correctly 2. Students are able to utilize research centers both locally and nationally with competitive Technology Applications and Innovation Products 3. Able to have conservation insights on natural and human resources in applying science and technology

	for the benefit of Sustainable Development with SDG's Theories and Concepts. 4. Able to complete the making of Student Creativity Program (PKM) Proposals and similar programs in preparing project-based innovations with PKM Proposal Outputs (Articles, Posters and Videos). *10. Mahasiswa paham mengenai garis besar perkuliahan dari awal sampai akhir, mampu memahami Pengetahuan dan Konsep Literasi Digital dengan berfikir secara sistematis dalam menyelesaikan permasalahan umum dengan baik dan benar* *11. Mahasiswa Mampu mendayagunakan Pusat-Pusat penelitian baik lokal maupun nasional dengan Aplikasi Teknologi serta Produk Inovasi yang berdaya saing* *12. Mampu memiliki wawasan konservasi terhadap sumber daya alam dan manusia dalam menerapkan ilmu pengetahuan dan teknologi untuk kepentingan Pembangunan Berkelanjutandengan Teori dan Konsep SDG's.* *13. Mampu menyelesaikan pembuatan Proposal Program Kreativitas Mahasiswa (PKM) dan program sejenis dalam menyiapkan project based inovasi dengan Luaran Proposal PKM (Artikel , Poster dan Video).*
Content (*Materi Pembelajaran*)	1. Digital Literacy Knowledge and Concepts 2. Systems Thinking Theory and Information Transformation 3. Artificial Intelligence Introduction and Science Technopark Knowledge (STP) 4. ITS and National Research Roadmap Knowledge 5. Innovative Creative Knowledge 6. SDGs Concept (Sustainable Development Goals) 7. Open Source Technology and IT Ethics 8. Student Creative Program (PKM) Proposal Concept

	• *Pengetahuan dan Konsep Literasi Digital* • *Teori Berpikir Sistem dan Transformasi Informasi* • *Pengantar Artificial Intelligence dan Pengetahuan Science Technopark (STP)* • *Pengetahuan Roadmap Riset ITS dan Nasional* • *Pengetahuan Kreatif Inovatif* • *Konsep SDGs (Sustainable Development Goals)* • *Teknologi Open Source dan Etika IT* • *Konsep Proposal Program Kreatif Mahasiswa (PKM)*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 1. Pengetahuan dan Konsep Literasi Digital 2. Teori Berpikir Sistem dan Transformasi Informasi 3. Pengantar Artificial Intelligence dan Pengetahuan Science Technopark (STP) 4. Pengetahuan Roadmap Riset ITS dan Nasional 5. Pengetahuan Kreatif Inovatif 6. Konsep SDGs (Sustainable Development Goals) 7. Teknologi Open Source dan Etika IT 8. Konsep Proposal Program Kreatif Mahasiswa (PKM) 9. Digital Literacy : Tools and Methodologies for Information Society. Pier Casera Rivoltella, Universitas Cottolica del Sacro Cuore, Italy 10. Akhmad Hidayatno, “BERPIKIR SISTEM”, Pola Pikir Untuk Pemahaman Masalah Yang Lebih baik. 2016. Universitay of Indonesia. 11. Gerakan Literasi Nasional, Kementrian Pendidikan dan Kebudayaan Jakarta, 2017

	12. Buku Tim Pengembang Mata Kuliah Wawasan Teknologi dan Komunikasi Ilmiah , “Wawasan Teknologi & 13. Komunikasi Ilmiah”, ITS Press, Surabaya, 2015. 14. Alfred Watkins and Michel Ehst, “Science, Technology and Innovation: Capacity Building for Sustainable 15. Growth and Poverty Reduction”, The International Bank for Reconstruction and Development, Washington DC, 2008. 16. Frieder Meyer Krahmer, “Innovation and Sustainable Development-Lesson for Innovation Policies, “ A Springer-Verlag Company, Heidelberg, 1998. 17. Buku : ARAHAN Pelaksanaan Tujuan Pembangunan Berkelanjutan/SDGsTeam Leader Sekretariat SDGs 18. Kementerian PPN/Bappenas, 1 Februari 2018, Alamat Kontak: Website : sdgs.bappenas.go.id Supporting (*Pendukung*): 1. -

Professional Ethics

Course (*Mata Kuliah*)	**Professional Ethics (*Etika Profesi*)**
Code (*Kode Mata Kuliah*)	EF234701
Semester	7
Lecturer (*Dosen Pengampu*)	•
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	4. Lectures (*Tatap muka*): 3x50'/week 5. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 6. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Through the Professional Ethics course, students are expected to be able to understand law and professional ethics, especially related to the field of information technology. *Melalui mata kuliah Etika Profesi, mahasiswa diharapkan mampu memahami hukum dan etika profesional terutama terkait dengan bidang teknologi informasi*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand ethical norms and laws related to information technology 2. Students are able to have awareness of professional behavior in the world of work 3. Students are able to think critically and solve problems.

	11. Mahasiswa mampu memahami norma etika dan undang-undang terkait teknologi informasi *12. Mahasiswa mampu memiliki kesadaran perilaku profesional dalam dunia kerja* *13. Mahasiswa mampu berpikir kritis dan menyelesaikan masalah*
Content (*Materi Pembelajaran*)	• ITE and Copyright Law • Positive behavior in the world of work • Critical thinking and problem solving • *Undang-undang ITE dan Hak Cipta* • *Perilaku positif di dunia kerja* • *Berpikir kritis dan menyelesaikan masalah*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	5. Exercises 6. Quiz 7. Midtest 8. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): 3. Undang-Undang Nomor 11 Tahun 2008 Tentang Informasi Dan Transaksi Elektronik 4. Undang-Undang Nomor 19 Tahun 2016 tentang Perubahan Atas Undang-Undang Nomor 11 Tahun 2008 Tentang Informasi dan Transaksi Elektronik 5. UU No. 19 Tahun 2002 tentang Hak Cipta Supporting (*Pendukung*): 1. Science and Technology Ethics, Dr Raymond E.Spier, Raymond E. Spier, 2001 2. Professional Ethics and Etiquette, Ferguson Pub.Co, 2009

Undergraduate Pre-Thesis

Course (*Mata Kuliah*)	**Undergraduate Pre-Thesis (*Proposal Tugas Akhir dan Informatika Cerdas*)**
Code (*Kode Mata Kuliah*)	EF234702
Semester	7
Lecturer (*Dosen Pengampu*)	• Eka Dian Savitri, S. Hum., M.A. • Dra. Siti Zahrok, M.Pd. • Dra. Enie Hendrajati, M.Pd.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	1. Pre-Thesis Draft Writing and Lecturer Guidance (*Penyusunan Draft Poposal Tugas Akhir dan Bimbingan Dosen)*
Credit points (*SKS*)	2
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This lecture aims to equip students in compiling Final Project proposals including extracting ideas to solve a problem, compiling background, problem formulation, goals and benefits. Compile a literature review and theoretical basis and research methodology from the Final Project *Perkuliahan ini bertujuan untuk membekali mahasiswa dalam menyusun proposal Tugas Akhir meliputi penggalian ide untuk menyelesaikan suatu permasalahan, menyusun latar belakang, rumusan masalah, tujuan dan manfaat. Menyusun tinjauan pustaka dan dasar teori serta metodologi penelitian dari Tugas Akhir*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to identify a real problem and its solution as the topic of the Final Project 2. Students are able to identify and compile the background, problem formulation, goals and benefits of a Final Project proposal 3. Students are able to identify and compile literature reviews and theoretical bases in a Final Project proposal 4. Students are able to identify and compile research methodologies in a Final Project proposal *1. Mahasiswa mampu mengidentifikasi suatu permasalahan nyata dan solusinya sebagai topik Tugas Akhir* *2. Mahasiswa mampu mengidentifikasi dan menyusun latar belakang, rumusan masalah, tujuan dan manfaat pada sebuah proposal Tugas Akhir* *3. Mahasiswa mampu mengidentifikasi dan menyusun tinjauan pustaka dan dasar teori pada sebuah proposal Tugas Akhir* *4. Mahasiswa mampu mengidentifikasi dan menyusun metodologi penelitian pada sebuah proposal Tugas Akhir*
Content (*Materi Pembelajaran*)	• Excavation and exploration of Final Project ideas • Preparation of background and motivation for the Final Project • Preparation of problem formulation, objectives and benefits of the Final Project • Preparation of literature review and theoretical basis of Final Project • Preparation of research methodology • *Penggalian dan eksplorasi ide Tugas Akhir* • *Penyusunan latar belakang dan motivasi Tugas Akhir* • *Penyusunan rumusan masalah, tujuan dan manfaat Tugas Akhir* • *Penyusunan tinjauan pustaka dan dasar terori Tugas Akhir*

	• *Penyusunan metodologi penelitian*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	• Undergraduate Pre-thesis Proposal Draft (*Draft Proposal Tugas Akhir)*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): Supporting (*Pendukung*):

IoT Technology (Teknologi IoT)

Course (*Mata Kuliah*)	**IoT Technology (*Teknologi IoT*)**
Code (*Kode Mata Kuliah*)	EF234703
Semester	7
Lecturer (*Dosen Pengampu*)	Ir. Ary Mazharuddin Shiddiqi, S.Kom., M.Comp.Sc., Ph.D.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This course discusses IoT developments, IoT architecture, resource management and data analysis, communication protocols, IoT applications, security, and authentication. *Mata kuliah ini membahas tentang perkembangan IoT, arsitektur IoT, manajemen resouce dan analisis data, protokol komunikasi, aplikasi IoT, keamanan, dan autentikasi.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Convey knowledge, implementation, and practices of IoT simulators and tools that are physical. 2. Able to implement IoT technology that is spread and designed to operate in a synchronized manner. *1. Memberikan pengetahuan, implementasi, dan menggunakan simulator dan piranti IoT yang berwujud fisik.*

	2. Mampu mengimplementasikan teknologi IoT yang tersebar dan dirancang untuk beroperasi secara tersinkronisasi.
Content (*Materi Pembelajaran*)	• IoT supporting infrastructure • IoT collaboration and programming framework • Fog Computing: Principles, Architecture, and Applications • Embedded systems • Data stream processing in IoT • Distributed Data Analysis in IoT • Security and Privacy in IoT • *Infrastruktur pendukung IoT* • *Framework kolaborasi dan pemrograman IoT* • *Fog Computing: Prinsip, Arsitektur, dan Aplikasinya* • *Embedded Systems* • *Data Stream Processing pada IoT* • *Distributed Data Analysis pada IoT* • *Security dan Privacy pada IoT*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Lynn, T., Endo, P.T., Ribeiro, A.M.N.C., Barbosa, G.B.N., Rosati, P. (2020). The Internet of Things: Definitions, Key Concepts, and Reference Architectures. In: Lynn, T., Mooney, J., Lee, B., Endo, P. (eds) The Cloud-to-Thing Continuum. Palgrave Studies in Digital Business & Enabling Technologies. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-41110-7_1

	2. Buyya Rajkumar, Dastjerdi Amir Vahid, 2016, Internet of Things – Principles and Paradigms, Cambridge: Morgan Kaufmann. Supporting: -

Digital Forensics (Forensik Digital)

Course (*Mata Kuliah*)	**Digital Forensics (*Forensik Digital*)**
Code (*Kode Mata Kuliah*)	EF234705
Semester	7
Lecturer (*Dosen Pengampu*)	Hudan Studiawan, S.Kom., M.Kom., Ph.D.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	4. Lectures (*Tatap muka*): 3x50'/week 5. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 6. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Network Programming (*Pemrograman Jaringan*)
Course Description (*Deskripsi Mata Kuliah*)	Digital Forensics courses provide students with knowledge and skills about forensic methodology, forensic investigations on various artifact objects such as files, operating systems, and emails. Apart from that, forensic methods are also applied to hardware such as memory, disks, and also to computer networks. *Kuliah Forensik Digital memberikan pengetahuan dan ketrampilan kepada mahasiswa tentang metodologi forensik, investigasi forensik pada berbagai objek artifak seperti berkas, sistem operasi, dan email. Selain itu, metode forensik juga diterapkan pada perangkat keras seperti memori, disk, dan juga pada jaringan komputer.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	5. Students are able to understand and explain the methodology in carrying out digital forensics. 6. Students are able to understand and apply forensic methods in file, operating system, web, and email environments.

	7. Students are able to understand and explain forensic methods on memory, disks and computer networks. 8. Students are able to understand and explain the concepts and principles of forensic methods on mobile devices and anti-forensic techniques. *5. Mahasiswa mampu memahami dan menjelaskan metodologi dalam melaksanakan forensik digital.* *6. Mahasiswa mampu memahami dan menerapkan metode forensik pada lingkungan berkas, sistem operasi, web, dan email.* *7. Mahasiswa mampu memahami dan menjelaskan metode forensik pada memori, disk, dan jaringan komputer.* *8. Mahasiswa mampu memahami dan menjelaskan konsep dan prinsip metode forensik pada perangkat bergerak dan teknik antiforensik.*
Content (*Materi Pembelajaran*)	• Data, Information, and Knowledge • Discrete Probability • Web Security • Digital Forensics • Secure Software Engineering • *Data, Informasi, dan Pengetahuan* • *Probabilitas Diskrit* • *Keamanan Web* • *Forensik Digital* • *Rekayasa Perangkat Lunak yang Aman*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*

Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Nelson, B., Phillips, A., & Steuart, C. (2019). Guide to Computer Forensics and Investigations. Cengage Learning. 2. Holt, T. J., Bossler, A. M., & Seigfried-Spellar, K. C. (2022). Cybercrime and digital forensics: An introduction. Routledge. Supporting: 1. Johansen, G. (2022). Digital Forensics and Incident Response: Incident Response Techniques and Procedures to Respond to Modern Cyber Threats. Packt Publishing Ltd. 2. Gogolin, G. (Ed.). (2021). Digital Forensics Explained. CRC Press.

Signal Processing Programming (Pemrograman Pengolahan Sinyal)

Course (*Mata Kuliah*)	**Signal Processing Programming (*Pemrograman Pengolahan Sinyal*)**
Code (*Kode Mata Kuliah*)	EF234706
Semester	7
Lecturer (*Dosen Pengampu*)	Dr. Dwi Sunaryono, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Algorithm Design and Analysis (*Perancangan dan Analisis Algoritma*)
Course Description (*Deskripsi Mata Kuliah*)	The Signal Processing Programming course is designed to provide students with knowledge related to processing data from various data sources which are then processed to produce a prediction model which is applied as data recognition from the input provided. *Mata kuliah Pemrograman Pengolah Sinyal dirancang untuk memberikan pengetahuan bagi mahasiswa berkaitan dengan pengolahan data dengan berbagai macam sumber data kemudian diolah untuk menghasilkan model prediksi yang diterapkan sebagai pengenalan data dari input yang diberikan.*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students understand the concepts and applications of signal processing programming. 2. Students understand how to process various data formats, including images, text, signals.

	3. Students are able to create signal processing programs, both individually and in teamwork. 4. Students are able to create prediction models with various data sources. *1. Mahasiswa memahami konsep dan terapan dari pemrograman pengolahan sinyal.* *2. Mahasiswa memahami mengolah berbagai format data baik citra, text, sinyal.* *3. Mahasiswa mampu membuat program pengolah sinyal, baik secara individual maupun kerja sama tim.* *4. Mahasiswa mampu membuat model prediksi dengan berbagai macam sumber data.*
Content (*Materi Pembelajaran*)	• Basic Analysis • Advanced Data Structures, Algorithms, and Analysis • Data, Information, and Knowledge • Advanced Programming Constructs • Logic Programming • Parallelism • Concurrency and Parallelism • Runtime Systems • Functional Programming • Parallel Algorithms, Analysis, and Programming • Web Platforms • Real Time and Embedded Systems • *Analisis Dasar* • *Struktur Data Tingkat Lanjut, Algoritma, dan Analisis* • *Data, Informasi, dan Pengetahuan* • *Konstruksi Pemrograman Tingkat Lanjut* • *Pemrograman Logika* • *Paralelisme* • *Konkurensi dan Paralelisme* • *Sistem Waktu Proses* • *Pemrograman Fungsional* • *Algoritma, Analisis, dan Pemrograman Paralel* • *Platform Web*

	• *Sistem Waktu Nyata dan Tertanam*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Sanjit K. Mitra, Digital Signal Processing, 3e: A Computer Based Approach, University of California at Santa Barbara, McGraw-Hill, 2006. 2. Siuly Siuly, Yan Li, Yanchun Zhang, EEG Signal Analysis and Classification: Techniques and Applications, Spinger, 2018. 3. Saeid Sanei, Jonathon A. Chambers, "EEG Signal Processing and Machine Learning, 2nd Edition", John Willey, 2021. Supporting: 1. Manohar Swamynathan, "Mastering Machine Learning with Python in Six Steps", Apress, 2017. 2. Navin Kumar Manaswi, "Deep Learning with Applications Using Python, Apress, 2018. 3. Saeid Sanei and J.A. Chambers Centre of Digital Signal Processing Cardiff University, UK, "EEG SIGNAL PROCESSING", John Willey, 2007.

Multivariate Data Analysis (Analisis Data Multivariat)

Course (*Mata Kuliah*)	**Multivariate Data Analysis (*Analisis Data Multivariat*)**
Code (*Kode Mata Kuliah*)	EF234708
Semester	7
Lecturer (*Dosen Pengampu*)	Dr. Ahmad Saikhu, S.Si., MT. Arya Yudhi Wijaya, S.Kom, M.Kom. Victor Hariadi, S.Si., M.Kom. Prof. Dr. Ir. Joko Lianto Buliali, M.Sc. Dr. Bilqis Amaliah, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Probabilistic and Statistic (*Probabilitas dan Statistika*)
Course Description (*Deskripsi Mata Kuliah*)	This course explains strong skills and knowledge to formulate and solve multivariate data analysis and modeling using both descriptive approaches and various inferential methods which include grouping, dimension reduction, and models of interdependent relationships between variables so that the data provides meaning and information as a basis for drawing conclusions. *Mata kuliah ini menjelaskan keterampilan dan pengetahuan yang kuat untuk merumuskan dan memecahkan analisis dan pemodelan data yang bersifat multivariat baik menggunakan pendekatan deskriptif maupun berbagai metode inferensia yang meliputi pengelompokan, reduksi dimensi, dan model hubungan*

	interdepensi antar variabel sehingga data memberikan makna dan informasi sebagai dasar pengambilan kesimpulan.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students can identify types of analysis and models that are suitable for various types of data using univariate and multivariate methods. 2. Students can carry out descriptive analysis of multivariate data using EDA techniques. 3. Students can carry out dimension reduction of group modeling data (clustering), classification, and factor analysis. 4. Students can model interdependence relationships between variables that are multivariate using the PCA, Manova/Mancova, Linear Discriminant Analysis, and Canonical Correlation methods. 1. *Mahasiswa dapat mengidentifikasi tipe analisis dan model yang sesuai untuk berbagai macam data dengan metode univariat dan multivariat.* 2. *Mahasiswa dapat melakukan analisis secara deskriptif untuk data multivariat dengan teknik EDA.* 3. *Mahasiswa dapat melakukan reduksi dimensi data pemodelan grup (clustering), klasifikasi, dan analisis faktor.* 4. *Mahasiswa dapat memodelkan hubungan interdependensi antar variabel yang bersifat multivariat dengan metode PCA, Manova/Mancova, Linear Discriminant Analysis, dan Canonical Correlation.*
Content (*Materi Pembelajaran*)	• Exploratory Data Analysis (EDA) • Principal Components Analysis (PCA) • Factor Analysis (FA) • Multiple Regression dan Multivariate Regression • Multiple Discriminant Analysis • MANOVA & MANCOVA • Conjoint Analysis • Canonical Correlation • Cluster Analysis

	• Multidimensional Scaling • Correspondence Analysis • *Exploratory Data Analysis (EDA)* • *Principal Components Analysis (PCA)* • *Factor Analysis (FA)* • *Regresi Berganda dan Regresi Multivariat* • *Analisis Diskriminan Berganda* • *MANOVA & MANCOVA* • *Analisis Konjoin* • *Korelasi Kanonik* • *Analisis Klaster* • *Penskalaan Multidimensi* • *Analisis Korespondensi*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam 1. *Latihan soal* 2. *Kuis* 3. *Evaluasi Tengah Semester* 4. *Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Barbara G. Tabachnick, Linda S. Fidell, “Using Multivariate Statistics”, Fifth Edition, Pearson Int., 2007. 2. Hair, Joseph F., dkk, "Multivariate Data Analysis", Sixth Edition, Prentice Hall, New Jersey, 2006. Supporting: 1. Richard A. Johnson, Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Sixth Edition, Prenctice Hall International Inc, 2006.

Object Oriented Simulation (Simulasi Berorientasi Obyek)

Course (*Mata Kuliah*)	**Object Oriented Simulation (*Simulasi Berorientasi Obyek*)**
Code (*Kode Mata Kuliah*)	EF234709
Semester	7
Lecturer (*Dosen Pengampu*)	Prof. Dr. Ir. Joko Lianto Buliali, M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Modeling and Simulation (*Pemodelan dan Simulasi*)
Course Description (*Deskripsi Mata Kuliah*)	Object Oriented Simulation aims to give students the ability to understand the concept of Object Orientation and how to apply it in creating simulation models, as well as executing Object Oriented Simulation models which are ultimately used as support for decision making on one or more parameters of the system being simulated. *Simulasi Berorientasi Objek bertujuan untuk memberikan mahasiswa kemampuan untuk memahami konsep Orientasi Objek dan bagaimana menerapkannya dalam pembuatan model simulasi, serta melakukan eksekusi model Simulasi Berorientasi Objek yang pada akhirnya digunakan sebagai dukungan untuk pengambilan keputusan pada satu atau lebih parameter sistem yang disimulasikan.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the concept of Object Orientation, use the concept of Object Orientation in creating simulation models, and find solutions with Object Oriented Simulation. 2. Students are able to create an object oriented simulation model from the description of the given problem. 3. Students are able to use object oriented simulation tools to execute object oriented simulation models created. 4. Students are able to analyze the output of the object oriented simulation model execution results. *1. Mahasiswa mampu menjelaskan konsep Orientasi Objek, menggunakan konsep Orientasi Objek dalam pembuatan model simulasi, dan menemukan solusi dengan Simulasi Berorientasi Objek.* *2. Mahasiswa mampu membuat model Simulasi Berorientasi Objek dari deskripsi masalah yang diberikan.* *3. Mahasiswa mampu menggunakan kakas Simulasi Berorientasi Objek untuk mengeksekusi model Simulasi Berorientasi Objek yang dibuat.* *4. Mahasiswa mampu melakukan analisis luaran hasil eksekusi Simulasi Berorientasi Objek.*
Content (*Materi Pembelajaran*)	• Concept of object orientation and Object Oriented Simulation. • Object Oriented Simulation Model of problem description. • Uses Object Oriented Simulation tools to execute the created Object Oriented Simulation models. • Output analysis of Object Oriented Simulation execution results. • *Konsep orientasi objek dan Simulasi Berorientasi Objek.* • *Model Simulasi Berorientasi Objek dari deskripsi masalah.*

	• *Menggunakan kakas Simulasi Berorientasi Objek untuk mengeksekusi model Simulasi Berorientasi Objek yang dibuat.* • *Analisis luaran hasil eksekusi Simulasi Berorientasi Objek.*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. José M. Garrido. Object Oriented Simulation: A Modeling and Programming Perspective. Springer New York, NY. ISBN 978-1-4419-5500-5. 2009. 2. James V. Leonard, George W. Zobrist. Object-Oriented Simulation: Reusability, Adaptability, Maintainability 1st Edition. Wiley-IEEE Press. 1996. Supporting: -

Smart Game (Game Cerdas)

Course (*Mata Kuliah*)	**Smart Game (*Game Cerdas*)**
Code (*Kode Mata Kuliah*)	EF234710
Semester	7
Lecturer (*Dosen Pengampu*)	Dr. Eng. Darlis Herumurti, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The material in the Smart Game Course at the beginning of the meeting discussed the history of the development of AI Game and examples of recent research publications as well as the application of artificial intelligence to adaptive games, including agent movement, path planning and finding. The next material is related to decision making using finite states, Rule-base systems, Decision Trees, etc., as well as the application of learning capabilities to agents using reinforcement learning, imitation, deep learning, etc. which are applied to game engine platforms such as Unity, Unity ML Agent and/or other similar platforms. The final material is related to the application of the Procedural Content Generator (PCD) to build adaptive games to generate levels/difficulty levels, quests, environments, items, and rules automatically. *Materi dalam Mata Kuliah Game Cerdas diawal pertemuan membahas sejarah perkembangan Game AI*

	dan contoh-contoh publikasi penelitian terkini serta penerapan kecerdasan buatan pada gim yang adaptif, meliputi pergerakan agent, perencanaan dan pencarian jalur. Materi selanjutnya terkait dengan pengambilan keputusan menggunakan finite state, Rule-base system, Decision Tree, dll, serta penerapan kemampuan learning pada agen menggunakan reinforcement learning, imitation, deep learning dll yang diterapkan pada platform game engine seperti unity, Unity ML Agent dan/atau platform lain yang sejenis. Materi terakhir adalah terkait penerapan Procedural Content Generator (PCD) untuk membangun gim yang adaptif untuk menggenerate level/tingkat kesulitan, quest, lingkungan, item-item, dan aturan secara otomatis.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the latest research and examples of the application of artificial intelligence to games. 2. Students are able to apply learning and decision making methods using the Unity ML Agent toolkit. 3. Students are able to use the Unity ML Agent toolkit to create games with case studies. 4. Students are able to create adaptive games by applying artificial intelligence methods. *1. Mahasiswa mampu memahami penelitian terbaru dan contoh-contoh penerapan kecerdasan buatan pada Gim.* *2. Mahasiswa mampu menerapkan metode pembelajaran dan pengambilan keputusan menggunakan Unity ML Agent toolkit.* *3. Mahasiswa mampu menggunakan Unity ML Agent toolkit untuk membuat Gim dengan studi kasus.* *4. Mahasiswa mampu membuat Gim yang adaptif dengan menerapkan metode kecerdasan buatan.*
Content (*Materi Pembelajaran*)	• Introduction to Smart Games Course: Research and application of games that apply artificial intelligence • Agent Movement and Path Finding

	• Decision Making: FSM, Rule-base system, Decision Tree, etc • Learning • Programming on the Unity Platform and Unity ML Agent toolkit • Procedural Content Generation • *Pengantar Mata Kuliah Game Cerdas: Penelitian dan aplikasi Gim yang menerapkan kecerdasan buatan* • *Pergerakan Agen dan Pencarian Jalur* • *Pengambilan Keputusan: FSM, Rule-base system, Decision Tree, dll.* • *Pembelajaran* • *Pemrograman pada Platform Unity dan Unity ML Agent toolkit* • *Pembuatan Konten Prosedural*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. AI for Games, Third Edition, by Ian Millington, 2019, Publisher(s): CRC Press 2. https://blog.unity.com/technology/introducing-unity-machine-learning-agents 3. IEEE Transactions on Games Supporting: -

X Reality (Realitas X)

Course (*Mata Kuliah*)	**X Reality (*Realitas X*)**
Code (*Kode Mata Kuliah*)	EF234711
Semester	7
Lecturer (*Dosen Pengampu*)	Hadziq Fabroyir, S.Kom., Ph.D. Siska Arifiani, S.Kom., M.Kom.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Computer Graphics (*Grafika Komputer*)
Course Description (*Deskripsi Mata Kuliah*)	This course covers the design and technical discussions required for implementing immersive environments on the Extended Reality (XR) platform, namely virtual reality (VR), augmented reality (AR), and mixed reality (MR). The discussion will combine computing and interaction topics including the evolution of several supporting technologies such as visual displays, motion tracking, interactive 3D graphics, multimodal sensor integration, spatial audio, user interfaces, IoT, games, and experience design. Through this course, students are expected to be able to understand input and output elements in extended reality, model objects in a virtual environment, program interactions between users and virtual objects, and develop extended reality using a game engine to solve real-world problems.

	Mata kuliah ini mencakup pembahasan desain dan teknis yang dibutuhkan untuk implementasi lingkungan imersif pada platform Realitas X, yakni realitas virtual, realitas berimbuh, dan realitas campuran. Pembahasan akan memadukan topik-topik komputasi dan interaksi termasuk evolusi beberapa teknologi pendukung seperti tampilan visual, pelacak gerakan, grafika 3D interaktif, integrasi sensor multimodal, audio spasial, antarmuka pengguna, IoT, gim, dan desain pengalaman. Melalui kuliah ini, mahasiswa diharapkan mampu memahami elemen input dan output pada realitas x, memodelkan objek dalam lingkungan virtual, memrogram interaksi antara pengguna dan objek virtual, dan mengembangkan realitas x menggunakan mesin gim untuk menyelesaikan masalah di dunia nyata.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Able to understand the theory of extended reality comprehensively in terms of software, hardware, human physiology. 2. Able to explore and report the latest extended reality examples, including virtual reality (VR), augmented reality (AR), and mixed reality (MR). 3. Able to design and create 3D objects in immersive environments and to apply a natural interaction between the users and those objects/environments. 4. Able to understand the concept of immersion and apply it to extended reality. 5. Able to develop extended reality software using graphics libraries and/or game development engines both individually and in team to solve real-world problems. 1. *Mampu memahami teori realitas x secara menyeluruh dari segi perangkat lunak, perangkat keras, dan fisiologi manusia.* 2. *Mampu mengeksplorasi dan melaporkan contoh-contoh realitas x terkini, termasuk realitas virtual, realitas berimbuh, dan realitas campuran.*

	3. *Mampu merancang dan membuat objek 3D pada lingkungan imersif, serta menerapkan interaksi alami antara pengguna dan objek/lingkungan tersebut.* 4. *Mampu memahami konsep imersi dan menerapkannya pada realitas x.* 5. *Mampu mengembangkan perangkat lunak realitas x menggunakan pustaka grafika dan/atau mesin pengembangan gim baik secara mandiri maupun kelompok untuk menyelesaikan masalah di dunia nyata.*
Content (*Materi Pembelajaran*)	• Virtual reality (VR): Immersive technology and experiences • Augmented reality (AR): Mobile-based, wearables • Mixed reality (MR): Cross-reality interaction, physical computing • XR outputs: VR head-mounted displays, AR glasses, spatial sound, haptic devices • XR inputs: controller sticks, motion tracking, motion capture, gesture control • Overview of usability factors, and human physiology and psychology • Procedural graphics and 3D interaction • Development of extended reality using web-based graphics libraries • Development of extended reality using game engines • Immersion, presence, fidelity • *Realitas virtual: Teknologi dan pengalaman imersif* • *Realitas berimbuh: Bergerak, dikenakan* • *Realitas campuran: Interaksi lintas realitas, komputasi fisik* • *Luaran realitas X: Layar yang dipasang di kepala, kacamata, suara spasial, perangkat haptik* • *Masukan realitas X: Batang kendali, pelacakan gerakan, penangkap gerakan, kontrol gestur* • *Tinjauan faktor ketergunaan, fisiologi, dan psikologi manusia*

	• *Grafika prosedural dan interaksi 3D* • *Pengembangan realitas x menggunakan pustaka grafika berbasis web* • *Pengembangan realitas x menggunakan mesin gim* • *Imersi, presensi, fideliti*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Hale, K. S., & Stanney, K. M. (Eds.). (2014). Handbook of virtual environments: Design, implementation, and applications. CRC Press. 2. Jerald, J. (2015). The VR book: Human-centered design for virtual reality. Morgan & Claypool. Supporting: 1. Heim, M. (1993). The metaphysics of virtual reality. Oxford University Press on Demand. 2. Noë, A. (2004). Action in perception. MIT press. 3. Parisi, T. (2015). Learning virtual reality: Developing immersive experiences and applications for desktop, web, and mobile. " O'Reilly Media, Inc.". 4. Turchet, L. (2015). Designing presence for real locomotion in immersive virtual environments: an affordance-based experiential approach. Virtual Reality, 19(3), 277-290. 5. LaViola Jr, J. J., Kruijff, E., McMahan, R. P., Bowman, D., & Poupyrev, I. P. (2017). 3D user interfaces: theory and practice. Addison-Wesley Professional. 6. Linowes, J. (2020). Unity 2020 Virtual Reality Projects: Learn VR development by building immersive

	applications and games with Unity 2019.4 and later versions. Packt Publishing Ltd. 7. Marr, B. (2021). Extended Reality in Practice: 100+ Amazing Ways Virtual, Augmented and Mixed Reality Are Changing Business and Society. John Wiley & Sons. 8. Baruah, R. (2021). AR and VR Using the WebXR API.

Big Data (Big Data)

Course (*Mata Kuliah*)	**Big Data**
Code (*Kode Mata Kuliah*)	EF234712
Semester	7
Lecturer (*Dosen Pengampu*)	Abdul Munif, S.Kom., M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	Big Data course material teaches students to master large-scale data storage and processing methods. Large-scale data storage methods are discussed by looking at theoretical aspects and implementation using the latest technology. The concept of distributed computing is discussed to show how to process large-scale data. The use of several data mining and modeling algorithms is used to present useful new information more effectively and efficiently. *Materi kuliah Big Data mengajarkan mahasiswa untuk menguasai metode penyimpanan dan pengolahan data skala besar. Metode penyimpanan data skala besar dibahas dengan melihat aspek teoritis dan implementasinya menggunakan teknologi terkini. Konsep komputasi terdistribusi dibahas untuk menunjukkan bagaimana pengolahan data skala besar. Penggunaan beberapa algoritma penggalian data dan pemodelan*

	digunakan untuk menyajikan informasi baru yang bermanfaat secara lebih efektif dan efisien.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the design and architecture of large-scale data storage systems (Hadoop, graph database, cloud storage, etc.) 2. Students are able to apply distributed computing frameworks to big data (Map-Reduce, Apache Spark). 3. Students are able to apply large-scale data processing/mining in real cases (classification, regression, clustering, recommendation systems, and social networks). 4. Students are able to apply optimization in large-scale data processing. *1. Mahasiswa mampu menjelaskan desain dan arsitektur sistem penyimpanan data berskala besar (Hadoop, graph database, cloud storage, dll.)* *2. Mahasiswa mampu menerapkan kerangka kerja komputasi terdistribusi pada big data (Map-Reduce, Apache Spark).* *3. Mahasiswa mampu menerapkan proses pengolahan/penggalian data skala besar dalam kasus nyata (klasifikasi, regresi, clustering, sistem rekomendasi, dan jejaring sosial).* *4. Mahasiswa mampu menerapkan optimasi dalam pengolahan data berskala besar.*
Content (*Materi Pembelajaran*)	• Data mining • Map-Reduce and Distributed Computing • Large-scale data processing algorithms/modeling: Finding similar items, mining data streams, link analysis, frequent item sets, clustering, classification, recommendation systems, mining social-network graph • Optimization of large-scale data processing: Dimensionality reduction, large-scale machine learning, neural networks, deep learning • *Penggalian data*

	• *Map-Reduce dan Komputasi terdistribusi* • *Algoritma/pemodelan pemrosesan data skala besar: Finding similar items, mining data streams, link analysis, frequent item sets, clustering, classification, recommendation systems, mining social-network graph* • *Optimasi pengolahan data skala besar: Dimensionality reduction, large-scale machine learning, neural network, deep learning*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Leskovec, J., Rajaraman, A., & Ullman, J. D. (2019). Mining of Massive Datasets (3rd ed.). Stanford University. Supporting: 1. Chambers, B., & Zaharia, M. (2018). Spark: The Definitive Guide. O'Reilly Media, Inc. 2. Shi, Y. (2022). Advances in Big Data Analytics. Springer Nature Singapore Pte Ltd. 3. Wolohan, J. T. (2019). Mastering Large Datasets with Python. Manning Publication Co.

Quantum Computing (Komputasi Kuantum)

Course (*Mata Kuliah*)	**Quantum Computing (*Komputasi Kuantum*)**
Code (*Kode Mata Kuliah*)	EF234713
Semester	7
Lecturer (*Dosen Pengampu*)	Abdul Munif, S.Kom., M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	The material in the Quantum Computing course teaches students about the quantum computing paradigm, the advantages and limitations of quantum computing, the postulates of quantum mechanics and their application to computing, the principles of quantum information and quantum communication, fundamental quantum algorithms, and the implications of quantum computing on machine learning, cryptography, and information security. *Materi dalam mata kuliah Komputasi Kuantum mengajarkan mahasiswa tentang paradigma komputasi kuantum, keunggulan dan batasan komputasi kuantum, postulat mekanika kuantum dan aplikasinya pada komuptasi, prinsip informasi kuantum dan komunikasi kuantum, algoritma kuantum fundamental, dan implikasi komputasi kuantum pada pembelajaran mesin, kriptografi, dan keamanan informasi.*

Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the quantum computing paradigm. 2. Students are able to understand the advantages and limitations of quantum computers. 3. Students are able to explain the four postulates of quantum mechanics and their application to computing. 4. Students are able to understand the principles of quantum information and quantum communication. 5. Students are able to analyze fundamental quantum algorithms. 6. Students are able to understand the implications of quantum computing on machine learning, cryptography, and information security. *1. Mahasiswa mampu memahami paradigma komputasi kuantum.* *2. Mahasiswa mampu memahami keunggulan dan batasan komputer kuantum.* *3. Mahasiswa mampu menjelaskan empat postulat dari mekanika kuantum dan aplikasinya pada komputasi.* *4. Mahasiswa mampu memahami prinsip informasi kuantum dan komunikasi kuantum.* *5. Mahasiswa mampu menganalisis algoritma kuantum fundamental.* *6. Mahasiswa mampu memahami implikasi komputasi kuantum pada pembelajaran mesin, kriptografi, dan keamanan informasi.*
Content (*Materi Pembelajaran*)	• Quantum computing paradigm • Advantages and limitations of quantum computers • The four postulates of quantum mechanics and their applications to computing • Principles of quantum information and quantum communication • Fundamental quantum algorithms • Implications of quantum computing on machine learning, cryptography, and information security

	• *Paradigma komputasi kuantum* • *Keunggulan dan batasan komputer kuantum* • *Empat postulat dari mekanika kuantum dan aplikasinya pada komputasi* • *Prinsip informasi kuantum dan komunikasi kuantum* • *Algoritma kuantum fundamental* • *Implikasi komputasi kuantum pada pembelajaran mesin, kriptografi, dan keamanan informasi*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Bernhardt, C. (2019). Quantum computing for everyone. The MIT Press. 2. Nielsen, M. A., & Chuang, I. L. (2010). Quantum Computation and Quantum Information (10th Edition). Cambridge University Press. Supporting: 1. Aaronson, S. (2013). Quantum Computing Since Democritus. Cambridge University Press. 2. Hidary, J. D. (2021). Quantum Computing: An Applied Approach (Second Edition). Springer. 3. Johnston, E. R., Harrigan, N., & Gimeno-Segovia, M. (2019). Programming Quantum Computers (First Edition). O'Reilly Media, Inc. 4. Mermin, N. D. (2007). Quantum Computer Science: An Introduction. Cambridge University Press.

Software Architecture (Arsitektur Perangkat Lunak)

Course (*Mata Kuliah*)	**Software Architecture (*Arsitektur Perangkat Lunak*)**
Code (*Kode Mata Kuliah*)	ER234403
Semester	7
Lecturer (*Dosen Pengampu*)	Rizky Januar Akbar, S.Kom., M.Eng.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Software Design (*Perancangan Perangkat Lunak*)
Course Description (*Deskripsi Mata Kuliah*)	This course discusses how to carry out software architecture analysis and design on non-simple systems to meet functional requirements and quality attributes. Students will explore the elements of software architecture, understand the software architecture cycle and its impact on organizations, develop quality attribute scenarios using the Quality Attribute Workshop method, adapt architectural patterns and tactics into systems, carry out analysis and design using the Attribute-driven Design (ADD) method, document it, and evaluate the software architecture using the Architecture Tradeoff Analysis Method (ATAM). Students will carry out simulations based on case studies for each method. *Mata kuliah ini membahas tentang bagaimana melakukan analisis dan desain arsitektur perangkat lunak pada sistem nonsederhana untuk memenuhi kebutuhan fungsional dan atribut kualitas. Mahasiswa akan*

	mengeksplorasi elemen-elemen dari arsitektur perangkat lunak, memahami siklus arsitektur perangkat lunak dan pengaruhnya kepada organisasi, menyusun skenario atribut kualitas menggunakan metode Quality Attribute Workshop, mengadaptasi pola arsiktektural dan taktik ke dalam sistem, melakukan analisis dan desain menggunakan metode Attribute-driven Design (ADD), mendokumentasikannya, dan melakukan evaluasi arsitektur perangkat lunak menggunakan Architecture Tradeoff Analysis Method (ATAM). Mahasiswa akan melakukan simulasi berdasarkan studi kasus untuk setiap metode.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to explain the concept of software architecture. 2. Students are able to develop software quality attribute scenarios based on stakeholder needs. 3. Students are able to design and document software architecture on non-simple systems. 4. Students are able to evaluate software architecture. *1. Mahasiswa mampu menjelaskan konsep arsitektur perangkat lunak.* *2. Mahasiswa mampu menyusun skenario atribut kualitas perangkat lunak berdasarkan kebutuhan pemangku kepentingan.* *3. Mahasiswa mampu mendesain dan mendokumentasikan arsitektur perangkat lunak lunak pada sistem nonsederhan.* *4. Mahasiswa mampu mengevaluasi arsitektur perangkat lunak.*
Content (*Materi Pembelajaran*)	• Software architecture definition and cycle • Identify software quality attribute scenarios using the Quality Attribute Workshop (QAW) method • Architectural patterns and tactics • Analysis and design of software architecture using the Attribute-driven Design (ADD) method • Software architecture documentation: architectural views, notations, and architectural documents

	• Evaluate software architecture using the Architecture Tradeoff Analysis Method (ATAM) • *Definisi dan siklus arsitektur perangkat lunak* • *Identifikasi skenario atribut kualitas perangkat lunak menggunakan metode Quality Attribute Workshop (QAW)* • *Pola dan taktik arsitektural* • *Analisis dan desain arsitektur perangkat lunak menggunakan metode Attribute-driven Design (ADD)* • *Dokumentasi arsitektur perangkat lunak: architectural views, notasi, dan dokumen arsitektural* • *Evaluasi arsitektur perangkat lunak menggunakan Architecture Tradeoff Analysis Method (ATAM)*
Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Bass, Len, et al. Software Architecture in Practice, 4th Edition. 2021. 2. Clements, Paul, et al. Documenting Software Architectures: Views and Beyond. 2010. 3. Cervantes, Humberto, and Rick Kazman. Designing Software Architectures: A Practical Approach. 2016. Supporting: 1. Richards, Mark, and Neal Ford. Fundamentals of Software Architecture: An Engineering Approach. 2020. 2. Ford, Neal, et al. Software Architecture: The Hard Parts: Modern Trade-Off Analyses for Distributed Architectures. 2021.

Software Evolution (Evolusi Perangkat Lunak)

Course (*Mata Kuliah*)	**Software Evolution (*Evolusi Perangkat Lunak*)**
Code (*Kode Mata Kuliah*)	ER234505
Semester	7
Lecturer (*Dosen Pengampu*)	Ir. Siti Rochimah, M.T., Ph.D. Nurul Fajrin Ariyani, S.Kom., M.Sc.
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [elective] International undergraduate program, [elective]
Workload (*Beban*)	1. Lectures (*Tatap muka*): 3x50'/week 2. Exercises and Assignments (*Latihan dan Tugas*): 3x60'/week 3. Private Learning (*Belajar mandiri*): 3x60'/week
Credit points (*SKS*)	3
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian.
Mandatory prerequisites (*Mata kuliah prasyarat*)	Software Design (*Perancangan Perangkat Lunak*)
Course Description (*Deskripsi Mata Kuliah*)	This course provides the concepts and technology of software evolution. Lecture participants will be given the basic concepts and practices of software evolution that are currently developing. Topics include software evolution models and processes, reengineering, legacy systems, change impact analysis, software defects, refactorization, program understanding, and software reuse. Course assignments consist of presentations and project-based assignments on current topics in the domain of software evolution. *Mata kuliah ini memberikan konsep dan teknologi evolusi perangkat lunak. Peserta kuliah akan diberikan konsep dasar dan praktik evolusi perangkat lunak yang berkembang saat ini. Topik meliputi model dan proses evolusi perangkat lunak, rekayasa ulang, sistem legasi, analisis dampak pengubahan, kerusakan perangkat*

	lunak, refaktorisasi, pemahaman program, dan penggunaan kembali perangkat lunak. Tugas kuliah berupa presentasi dan tugas berbasis proyek tentang topik-topik terkini di ranah evolusi perangkat lunak.
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to understand the basic concepts and activities of software evolution: evolutionary models and processes; type of software evolution (corrective, adaptive, perfective, and preventive); legacy system, program understanding; software clutter; alteration impact analysis; software defects; and other basic activities. 2. Students are able to apply techniques in program understanding activities. Students are able to apply techniques in identifying bad smell codes, clone codes, and are able to use tools to carry out the process. Students are able to carry out the refactorization process. 3. Students are able to analyze the impact of software changes and software repository management. Students are able to evaluate software reuse and software defects prediction methods. 4. Students are able to apply the process of re-engineering and reusing software, and are able to analyze and evaluate the strengths and weaknesses of their engineering results. 1. *Mahasiswa mampu memahami konsep dasar dan aktivitas evolusi perangkat lunak: model dan proses evolusi; jenis evolusi perangkat lunak (korektif, adaptif, perfektif, dan preventif); sistem legasi, pemahaman program; kerunutan perangkat lunak; analisis dampak pengubahan; kerusakan perangkat lunak; dan aktivitas-aktivitas dasar lainnya.* 2. *Mahasiswa mampu menerapkan teknik-teknik dalam aktivitas pemahaman program. Mahasiswa mampu menerapkan teknik-teknik dalam identifikasi kode bad smell, kode klon, dan mampu menggunakan kakas*

	bantu dalam menjalankan prosesnya. Mahasiswa mampu melakukan proses refaktorisasi. 3. *Mahasiswa mampu menganalisis dampak pengubahan perangkat lunak dan manajemen repositori perangkat lunak. Mahasiswa mampu mengevaluasi penggunaan kembali perangkat lunak dan metode prediksi kerusakan perangkat lunak.* 4. *Mahasiswa mampu mengaplikasikan proses rekayasa ulang dan penggunaan kembali perangkat lunak, serta mampu menganalisis dan mengevaluasi keunggulan dan kelemahan pada hasil rekayasanya.*
Content (*Materi Pembelajaran*)	• Basic concepts and activities of software evolution: evolutionary models and processes; type of software evolution (corrective, adaptive, perfective, and preventive); legacy system • Program understanding techniques and activities • Identify bad smell code and clone code • Refactoring programs • Analyze the impact of software changes • Software repository management • Software reuse • Software defects • Software reengineering • *Konsep dasar dan aktivitas evolusi perangkat lunak: model dan proses evolusi; jenis evolusi perangkat lunak (korektif, adaptif, perfektif, dan preventif); sistem legasi* • *Teknik dan aktivitas pemahaman program* • *Identifikasi kode bad smell dan kode klon* • *Refaktorisasi program* • *Analisis dampak pengubahan perangkat lunak* • *Manajemen repositori perangkat lunak* • *Penggunaan kembali perangkat lunak* • *Kerusakan perangkat lunak* • *Rekayasa ulang perangkat lunak*

Study and examination requirements and forms of examination	1. Exercises 2. Quiz 3. Midtest 4. Final exam *1. Latihan soal* *2. Kuis* *3. Evaluasi Tengah Semester* *4. Evaluasi Akhir Semester*
Media employed	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list	Main: 1. Ralf Reussner et al., Managed Software Evolution, Springer Open, 2019. 2. P. Tripathy and K. Naik, Software Evolution and Maintenance: A Practitioner's Approach, Wiley, 2015. Supporting: 1. Tom Mens, Serge Demeyer, Software Evolution, Springer-Verlag, Berlin, 2008. 2. P. Grubb and A.A. Takang, Software Maintenance: Concepts and Practice, 2nd ed., World Scientific Publishing, 2003.

Semester 8

Undergraduate Thesis

Course (*Mata Kuliah*)	**Undergraduate Thesis (*Tugas Akhir*)**
Code (*Kode Mata Kuliah*)	EF234801
Semester	8
Lecturer (*Dosen Pengampu*)	-
Language (*Bahasa*)	Bahasa Indonesia and English
Relation to curriculum (*Hubungan pada kurikulum*)	Undergraduate program, [compulsory] International undergraduate program, [compulsory]
Workload (*Beban*)	4. Undergraduate Thesis Writing and Lecture Guidance (Penulisan Tugas Akhir dan Bimbingan Dosen)
Credit points (*SKS*)	5
Requirements according to the examination regulations (*Prasyarat Ujian*)	A student must have at least attended 80% of lectures to sit in the exams. *Mahasiswa harus hadir pada setidaknya 80% perkuliahan agar bisa mengikuti ujian*
Mandatory prerequisites (*Mata kuliah prasyarat*)	-
Course Description (*Deskripsi Mata Kuliah*)	This lecture aims to help students in implementing the system that has been designed, conducting trials and analyzing trial results, as well as compiling Final Project reports and presenting at the Final Project session *Perkuliahan ini bertujuan untuk membekali mahasiswa dalam mengimplementasi sistem yang sudah dirancang, melakukan ujicoba dan menganalisis hasil ujicoba, serta menyusun laporan Tugas Akhir dan mempresentasikan pada sidang Tugas Akhir*
Learning outcomes and their corresponding PLOs (*Capaian Pembelajaran Mata Kuliah*)	1. Students are able to implement the system design that has been made 2. Students are able to test and analyze the results of trials 3. Students are able to compile Final Project reports 4. Students are able to present Final Project material *1. Mahasiswa mampu mengimplementasi rancangan sistem yang sudah dibuat*

	2. *Mahasiswa mampu menguji dan menganalisis hasil ujicoba* 3. *Mahasiswa mampu menyusun laporan Tugas Akhir* 4. *Mahasiswa mampu mempresentasikan materi Tugas Akhir*
Content (*Materi Pembelajaran*)	• System design implementation • Test drive and analyze results • Preparation of final project report • Effective and efficient presentation • *Implementasi rancangan sistem* • *Ujicoba dan analisis hasil* • *Penyusunan laporan Tugas akhir* • *Presentasi efektif dan efesien*
Study and examination requirements and forms of examination (*Prasyarat Studi dan Evaluasi serta Bentuk Evaluasi*)	5. Undergraduate Thesis 5. *Laporan Tugas Akhir*
Media employed(*Media Pembelajaran*)	LCD, Whiteboard, websites (myITS Classroom), zoom
Reading list (*Pustaka*)	Main (*Utama*): Supporting (*Pendukung*):