

CURRICULUM DOCUMENT

MASTER OF INFORMATICS PROGRAM

INSTITUT TEKNOLOGI SEPULUH NOPEMBER, 2022



DOCUMENT

Preparation of Higher Education Curriculum

Master of Informatics Program

Institut Teknologi Sepuluh Nopember

Name of Team Leader : Dr. Ahmad Saikhu, S.Si., MT.
NIP/NIDN : 19710718 200604 1 001
Study Program : Master of Informatics Program
Faculty : Faculty of Intelligent Electrical and Informatics
Technology

INSTITUT TEKNOLOGI SEPULUH NOPEMBER, 2022



	INSTITUT TEKNOLOGI SEPULUH NOPEMBER Kampus ITS, Jl. Raya ITS, Keputih Sikolilo, Surabaya, 60111 Telpon (031) 5994251 URL www.its.ac.id	Number: 2.3.2.3.5.25.1
	CURRICULUM DOCUMENT	Revision: 1 Page : 413

Process	Person In Charge			Date
	Name	Position	Sign	
Formulator <i>Perumus</i>				
Examiner <i>Pemeriksa</i>				
Approver <i>Persetujuan</i>				
Determiner <i>Penetapan</i>				
Controler <i>Pengendalian</i>				



TABLE OF CONTENTS

TABLE OF CONTENTS	III
PREFACE	IV
IDENTIFICATION OF STUDY PROGRAM	V
1. CURRICULUM FOUNDATION (<i>LANDASAN KURIKULUM</i>)	1
1.1. UNIVERSITAS VALUE (<i>NILAI UNIVERSITAS</i>)	1
1.2. PHILOSOPHICAL FOUNDATION (<i>LANDASAN FILOSOFI</i>)	3
1.3. HISTORICAL FOUNDATION (<i>LANDASAN HISTORIS</i>)	3
1.4. LEGAL FOUNDATION (<i>LANDASAN HUKUM</i>)	5
2. VISION, MISSIONS, AND OBJECTIVE OF EDUCATION (<i>VISI, MISI, DAN TUJUAN PENDIDIKAN</i>)	5
2.1. VISION, MISSIONS, AND OBJECTIVE OF FACULTY (<i>VISI, MISI, DAN TUJUAN FAKULTAS</i>).....	5
2.2. VISION, MISSIONS, AND OBJECTIVE OF DEPARTMENT (<i>VISI, MISI, DAN TUJUAN DEPARTEMEN</i>)	6
2.3. VISION, MISSIONS, AND OBJECTIVE OF MASTER DEGREE PROGRAM (<i>VISI, MISI, DAN TUJUAN PROGRAM MAGISTER</i>)	7
3. CURRICULUM EVALUATION & TRACER STUDY (<i>EVALUASI KURIKULUM & TRACER STUDY</i>)	8
3.1. CURRICULUM EVALUATION (<i>EVALUASI KURIKULUM</i>).....	8
3.2. TRACER STUDY (<i>TRACER STUDY</i>).....	9
4. GRADUATE PROFILES & PROGRAM LEARNING OUTCOMES (<i>PROFIL LULUSAN & CAPAIAN PEMBELAJARAN LULUSAN</i>)	10
4.1. GRADUATE PROFILES (<i>PROFIL LULUSAN</i>).....	10
4.2. FORMULATION PLO (<i>PERUMUSAN CPL</i>)	12
4.3. RELATIONSHIP MATIX OF PLO AND GRADUATE PROFILES (<i>MATRIK HUBUNGAN CPL DENGAN PROFIL LULUSAN</i>).....	19
4.4. RELATIONSHIP MATIX OF PLO AND OBJECTIVE OF MASTER OF INFORMATICS PROGRAM (<i>MATRIK HUBUNGAN CPL DENGAN TUJUSN PROGRAM STUDI MAGISTER</i>)	20
5. DETERMINATION OF COURSE MATERIAL (<i>PENENTUAN BAHAN KAJIAN</i>)	20
5.1. DESCRIPTION OF BODY OF KNOWLEDGE (<i>GAMBARAN TUBUH PENGETAHUAN</i>)	20
5.2. DESCRIPTION OF COURSE MATERIAL (<i>GAMBARAN BAHAN KAJIAN</i>)	25
6. FORMATION OF COURSE AND DETERMINATION OF THE WEIGHT OF CREDITS (<i>PEMBENTUKAN MATA KULIAH DAN PENENTUAN BOBOT SKS</i>)	46
7. ORGANIZATION OF STUDY PROGRAM COURSES (<i>ORGANISASI MATA KULIAH PROGRAM STUDI</i>)	50
8. LIST OF COURSE DISTRIBUTION FOR EACH SEMESTER (<i>DAFTAR SEBARAN MATA KULIAH TIAP SEMESTER</i>)	52
9. LEARNING PLAN (<i>RENCANA PEMBELAJARAN SEMESTER</i>)	55
10. LEARNING MANAGEMENT (<i>PENGELOLAAN PEMBELAJARAN</i>)	86
10.1. TEACHING METHODOLOGY (<i>METODOLOGI PENGAJARAN</i>)	86
10.2. EXAM, SYSTEM, CONCEPT, AND ORGANIZATION (<i>UJIAN, SISTEM, KONSEP, DAN ORGANISASI</i>)	87



PREFACE

KATA PENGANTAR

Praise God, thanks to the presence of a merciful God for all His gifts so that the preparation of **the Master of Informatics curriculum document** can be completed.

*Puji Tuhan syukur ke hadirat Tuhan yang Maha Pengasih atas segala anugerah dan karunia-Nya sehingga penyusunan **dokumen kurikulum Magister Teknik Informatika** dapat diselesaikan.*

Many parties have provided assistance, guidance, and encouragement so that this curriculum document can be completed. Therefore, my sincere gratitude goes to the entire team who have put their energy and thoughts into the preparation of this document.

Banyak pihak yang telah memberikan bantuan, bimbingan, dan dorongan sehingga dokumen kurikulum ini dapat diselesaikan. Oleh karena itu, rasa terima kasih setulusnya disampaikan kepada seluruh tim yang sudah mencurahkan tenaga dan pemikirannya dalam penyusunan dokumen ini.

The authors hope that this document can be of use to both educators and readers in general. May God always bestow His blessings and mercy on all of us.

Harapan penyusun kiranya dokumen ini dapat bermanfaat bagi para pendidik maupun pembaca pada umumnya. Semoga Tuhan senantiasa melimpahkan berkat dan rahmat-Nya pada kita semua.

Surabaya, 14 April 2022



IDENTIFICATION OF STUDY PROGRAM

IDENTIFIKASI PROGRAM STUDI

1	Name of University <i>Nama Perguruan Tinggi (PT)</i>	INSTITUT TEKNOLOGI SEPULUH NOPEMBER
2	Faculty <i>Fakultas</i>	Faculty of Intelligent Electrical and Informatics Technology <i>Fakultas Teknologi Elektro dan Informatika Cerdas</i>
3	Department <i>Departemen</i>	Informatics <i>Teknik Informatika</i>
4	Study Program <i>Program Studi</i>	Master <i>Magister (S2)</i>
5	Accreditation Status <i>Status Akreditasi</i>	A
6	Number of Active Student <i>Jumlah Mahasiswa Aktif</i>	106
7	Number of Lecturer <i>Jumlah Dosen</i>	26
8	Address <i>Alamat</i>	Jl. Teknik Kimia - Gedung Departemen Teknik Informatika Jalan Raya ITS, Sukolilo, Surabaya, 60111 Indonesia
9	Telp <i>Telp</i>	+62-31-5939212, 5995581, 5994251 (ext 1445, 1446)
10	Website of Study Program <i>Website Program Studi</i>	https://www.its.ac.id/informatika/en/academic/study-program/magister-degree/



1. Curriculum Foundation (*Landasan Kurikulum*)

1.1. Universitas Value (*Nilai Universitas*)

Vision (*Visi*)

Become a world-class university that contributes to the independence of the nation and becomes a reference in education, research and community service also the development of innovation, especially those that support industry and marine.

Menjadi perguruan tinggi berkelas dunia yang berkontribusi pada kemandirian bangsa serta menjadi rujukan dalam pendidikan, penelitian dan pengabdian masyarakat serta pengembangan inovasi terutama yang menunjang industri dan kelautan.

Mission (*Misi*)

Contribute to science and technology for the welfare of society through activities in education, research, community service and management based on information and communication technology.

Memberikan kontribusi dalam ilmu pengetahuan dan teknologi untuk kesejahteraan masyarakat melalui kegiatan pendidikan, penelitian, pengabdian kepada masyarakat dan manajemen yang berbasis teknologi informasi dan komunikasi.

A. Education (*Bidang Pendidikan*)

1. Organizing information technology and communication-based higher education with curriculum, lecturers and international quality learning methods,
Menyelenggarakan pendidikan tinggi berbasis teknologi informasi dan komunikasi dengan kurikulum, dosen dan metode pembelajaran berkualitas internasional,
2. Create graduates who believe in the Almighty God also have moral and noble character,
Menghasilkan lulusan yang beriman dan bertakwa kepada Tuhan Yang Maha Esa serta memiliki moral dan budi pekerti yang luhur,
3. Equipping graduates with technology-based entrepreneurship knowledge
Membekali lulusan dengan pengetahuan kewirausahaan berbasis teknologi.

B. Research (*Bidang Penelitian*)

Take an active role in the development of science and technology, especially in the fields of maritime affairs, environment and settlements, energy, and environmental-based information and communication technology through international research activities.

Berperan aktif dalam pengembangan ilmu pengetahuan dan teknologi terutama di bidang kelautan, lingkungan dan permukiman, energi, serta teknologi informasi dan komunikasi yang berwawasan lingkungan melalui kegiatan penelitian internasional.

C. Community Service (*Bidang Pengabdian Masyarakat*)

Utilizing all the resources that are owned and participate to solve problems that are faced by the community, industry, central government, and local governments in organizing educational, research, and community service activities.

Memanfaatkan segala sumber daya yang dimiliki untuk ikut serta dalam menyelesaikan problem yang dihadapi oleh masyarakat, industri, pemerintah pusat, dan pemerintah daerah dalam menyelenggarakan kegiatan pendidikan, penelitian, dan pengabdian kepada masyarakat.

D. Management (*Bidang Manajemen*)

1. Institut Teknologi Sepuluh Nopember (ITS) management is carried out by noticing the principles of good governance which are supported by information and communication technology,



Pengelolaan Institut Teknologi Sepuluh Nopember (ITS) dilakukan dengan memperhatikan prinsip tata pamong yang baik yang didukung dengan teknologi informasi dan komunikasi,

2. Creating a conducive atmosphere and providing full support to students, lecturers, educational staff to be able to develop themselves and give maximum contributions to society, industry, science, and technology,
Menciptakan suasana yang kondusif dan memberikan dukungan sepenuhnya kepada mahasiswa, dosen, tenaga kependidikan untuk dapat mengembangkan diri dan memberikan kontribusi maksimum pada masyarakat, industri, ilmu pengetahuan dan teknologi,
3. Develop networks to synergize with other universities, industries, communities, and the central government, as well as local governments in organizing educational, research and community service activities,
Mengembangkan jejaring untuk dapat bersinergi dengan perguruan tinggi lain, industri, masyarakat, dan pemerintah pusat, serta pemerintah daerah dalam menyelenggarakan kegiatan pendidikan, penelitian dan pengabdian kepada masyarakat,
4. Utilizing information and communication technology in managing institution systems.
Memanfaatkan teknologi informasi dan komunikasi dalam melakukan pengelolaan sistem instansi.

ITS Values (Tata Nilai ITS)

1. Ethics and Integrity : in social life, as a state, or in carrying out their profession, always uphold honesty, commitment and upholding the norms or regulations that apply in society, the state and religion,
Etika dan Integritas : dalam kehidupan bermasyarakat, bernegara, maupun menjalankan profesinya, selalu menjunjung tinggi kejujuran, berkomitmen dan berpegang teguh pada norma-norma atau peraturan-peraturan yang berlaku di masyarakat, negara, dan agama,
2. Creativity and Innovation : always looking for new ideas to produce innovations in carrying out their duties / roles better,
Kreativitas dan inovasi : selalu mencari ide-ide baru untuk menghasilkan inovasi dalam menjalankan tugas/perannya dengan lebih baik,
3. Excellence : strive for maximum to achieve perfect results,
Ekselensi : berusaha secara maksimal untuk mencapai hasil yang sempurna,
4. Strong Leadership : demonstrate behavior that is visionary, creative, innovative, hardworking, daring to make changes for the better, and is responsible,
Kepemimpinan yang kuat : menunjukkan perilaku yang visioner, kreatif, inovatif, pekerja keras, berani melakukan perubahan-perubahan kearah yang lebih baik, dan bertanggungjawab,
5. Synergy : work together to be able to make the most of their potential,
Sinergi : bekerjasama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki,
6. Communication and Team Working : able to communicate well, be able to work together in completing work and take advantage of their potential,
Komunikasi dan Kerjasama Tim : mampu berkomunikasi dengan baik, dapat bekerjasama dalam menyelesaikan pekerjaan dan memanfaatkan potensi yang dimiliki,
7. Socio-cohesiveness and Social Responsibility : maintain harmony and care for the surrounding community,



Kebersamaan Sosial dan Tanggung Jawab Sosial : menjaga kerukunan dan peduli terhadap masyarakat sekitar,

8. Heroic Spirit : always inheriting the spirit of defending the State and always maintaining the dignity of the nation,

Semangat Kepahlawanan : selalu mewarisi jiwa bela Negara dan senantiasa menjaga martabat bangsa,

9. Autonomy : not dependent on others, taking initiative, working, overcoming obstacles on your own and always having self-confidence.

Kemandirian : tidak bergantung pada orang lain, berinisiatif, bekerja, mengatasi hambatan dengan kemampuan sendiri serta selalu memiliki rasa percaya diri.

1.2. Philosophical Foundation (*Landasan Filosofi*)

The philosophical foundation is based on UUD 45 and Pancasila.

Landasan filosofi didasarkan pada UUD 45 dan Pancasila.

1.3. Historical Foundation (*Landasan Historis*)

Higher education is directed to prepare the Indonesian nation for the era of industrial and information development. For this reason, the government through the Directorate General of Higher Education in 1985 instructed to open a new Bachelor Study Program for the field of computer technology at four universities or institutes in which ITS was included. At ITS, this program was originally given the name Computer Engineering Study Program. However, since 1993, the name of the Computer Engineering Study Program has been changed to the Department of Computer Engineering. Finally, in 1996 this department officially changed its name to the Department of Informatics based on the Decree of the Director General of Higher Education Number 224/DIKTI/Kep/1996, tanggal 11 Juli 1996.

Pendidikan tinggi diarahkan untuk mempersiapkan bangsa Indonesia dalam menghadapi era pembangunan industri dan informasi. Untuk itu pemerintah melalui Direktorat Jendral Pendidikan Tinggi pada tahun 1985 menginstruksikan untuk membuka Program Studi S1 baru untuk bidang ilmu teknologi komputer di empat universitas atau institut di mana ITS termasuk di dalamnya. Di ITS, program ini awalnya diberi nama Program Studi Teknik Komputer. Namun sejak tahun 1993, nama Program Studi Teknik Komputer diubah menjadi Jurusan Teknik Komputer. Akhirnya, pada tahun 1996 secara resmi jurusan ini berganti nama menjadi Jurusan Teknik Informatika berdasarkan Surat Keputusan Direktur Jendral Pendidikan Tinggi Nomor 224/DIKTI/Kep/1996, tanggal 11 Juli 1996.

In the 2001, DTIF established the Informatics Master Study Program (PMTIF) based on the Decree of the Director General of Higher Education No. 2851/D/T/2001, regarding the permit to administer the Strata-2 (S2) Study Program at the Institut Teknologi Sepuluh Nopember.

Pada tahun 2001, DTIF mendirikan Program Studi Master Teknik Informatika (PMTIF) berdasarkan Surat Keputusan Direktur Jendral Pendidikan Tinggi Nomor 2851/D/T/2001, tentang ijin penyelenggaraan Program Studi Jenjang Strata-2 (S2) pada Institut Teknologi Sepuluh Nopember.

In the 2003 - 2008 curriculum, the Informatics Master Study Program (PMTIF) has 3 Expertise Groups (KBK), namely: Smart Business Systems (SBC), Computer Network Architecture (AJK), and Software Engineering (RPL). In the 2009-2014 curriculum, PMTIF changed the names of 3 Expertise Groups (KBK), to Smart Computing and Visualization (KCV), Network-Based Computing (KBJ), and Software Engineering (RPL).



Pada kurikulum 2003 – 2008, Program Studi Master Teknik Informatika (PMTIF) mempunyai 3 Kelompok Bidang Keahlian (KBK), yaitu: Sistem Bisnis Cerdas (SBC), Arsitektur Jaringan Komputer (AJK), dan Rekayasa Perangkat Lunak (RPL). Pada kurikulum 2009-2014, PMTIF merubah nama 3 Kelompok Bidang Keahlian (KBK), menjadi Komputasi Cerdas dan Visualisasi (KCV), Komputasi Berbasis Jaringan (KBJ), dan Rekayasa Perangkat Lunak (RPL).

Due to scientific developments that refer to the 2013 ACM Computing Curricula Computer Science with 18 knowledge of areas, the PMTIF curriculum for the 2014-2019 period has changed and developed in the scientific fields from 3 KBK to 8 Subjects (RMK), namely: Architecture and Computer Networks (AJK), Programming Algorithms (AP), Basic and Applied Computing (DTK), Interaction, Graphics and Art (IGS), Network Based Computing (KBJ), Intelligent Computing and Vision (KCV), Information Management (MI) and Software Engineering (RPL). The eight RMKs were developed because there was a desire for a curriculum innovation based on Lab-Based Education (LBE), so that in the new curriculum all courses were developed based on the areas of expertise in the laboratories currently owned by the Department of Informatics (DTIF). There are 8 (eight) laboratories owned by DTIF in accordance with the number of RMK. In accordance with the LBE concept, the laboratory is responsible for the implementation of teaching, research, and community service.

Karena adanya perkembangan keilmuan yang mengacu pada ACM Computing Curricula Computer Science 2013 dengan 18 knowledge of areas, maka kurikulum PMTIF periode 2014-2019 mengalami perubahan dan pengembangan bidang keilmuan dari 3 KBK menjadi 8 Rumpun Matakuliah (RMK), yaitu: Arsitektur dan Jaringan Komputer (AJK), Algoritma Pemrograman (AP), Dasar dan Komputasi Terapan (DTK), Interaksi, Grafik dan Seni (IGS), Komputasi Berbasis Jaringan (KBJ), Komputasi Cerdas dan Visi (KCV), Manajemen Informasi (MI) serta Rekayasa Perangkat Lunak (RPL). Kedelapan RMK tersebut dikembangkan karena diinginkan adanya inovasi kurikulum yang berbasis pada Lab-Based Education (LBE), sehingga pada kurikulum yang baru semua mata kuliah tersebut dikembangkan berdasarkan bidang keahlian pada laboratorium-laboratorium yang dimiliki oleh Departemen Teknik Informatika (DTIF) saat ini. Adapun laboratorium yang dimiliki oleh DTIF sebanyak 8 (delapan) sesuai dengan jumlah RMK. Sesuai konsep LBE bahwa laboratorium bertanggung jawab pada pelaksanaan pengajaran, penelitian, dan pengabdian pada masyarakat.

In the changes to the 2018-2023 PMTIF curriculum, it still maintains the concept of 8 RMK as in the 2014-2019 curriculum, namely AJK, AP, DTK, IGS, KBJ, KCV, MI, and RPL. In 2020 there is a faculty restructuring policy, DTIF joins a new faculty with the name Faculty of Electrical and Intelligent Information Technology (FT-EIC). FT-EIC oversees 6 departments, namely Electrical Engineering, Informatics, Information Systems, Computer Engineering, Biomedical Engineering, and Information Technology. In 2020, PMTIF will still have 8 RMK with some RMK changing its name to: Computer Architecture and Networks (AJK), Programming Algorithms (AP), Graphics, Interaction, and Games (GIGa), Network-Based Computing (KBJ), Smart Computing and Vision (KCV), Intelligent Information Management (MCI), Modeling and Applied Computing (PKT), and Software Engineering (RPL).

Pada perubahan kurikulum PMTIF 2018-2023 tetap mempertahankan konsep adanya 8 RMK seperti pada kurikulum 2014-2019 yaitu AJK, AP, DTK, IGS, KBJ, KCV, MI, dan RPL. Pada tahun 2020 terdapat kebijakan restrukturisasi fakultas, DTIF bergabung ke fakultas baru dengan nama Fakultas Teknologi Elektro dan Informatika Cerdas (FT-EIC). FT-EIC membawahi 6 departemen yaitu Teknik Elektro, Teknik Informatika, Sistem Informasi, Teknik Komputer, Teknik Biomedik, dan Teknologi Informasi. Pada tahun 2020, PMTIF tetap memiliki 8 RMK dengan beberapa RMK merubah nama menjadi: Arsitektur dan Jaringan Komputer (AJK), Algoritma Pemrograman (AP), Grafik, Interaksi, dan Game (GIGa), Komputasi Berbasis Jaringan (KBJ), Komputasi Cerdas dan Visi (KCV), Manajemen Cerdas Informasi (MCI), Pemodelan dan Komputasi Terapan (PKT), serta Rekayasa Perangkat Lunak (RPL).



1.4. Legal Foundation (*Landasan Hukum*)

A curriculum document of Master of Informatics is formed on the basis of several regulations, such as:

1. UU 12 / 2012 about Higher Education
2. Permenristekdikti No. 44/2015 about National Higher Education Standards
3. Perpes No 8 / 2012 about Indonesian National Qualifications Framework
4. Permendikbud 3 / 2020 about National Higher Education Standards
5. Rector policy (Perek No. 17 / 2017) about Curriculum Evaluation Guidelines in Institut Teknologi Sepuluh Nopember (ITS)

Dokumen kurikulum untuk Magister Teknik Informatika dirancang berdasarkan beberapa peraturan, yaitu:

1. *UU 12 / 2012 tentang Pendidikan Tinggi*
2. *Permenristekdikti No. 44/2015 tentang Standar Nasional Pendidikan Tinggi*
3. *Perpes No 8 / 2012 mengenai Kerangka Kualifikasi Nasional Indonesia*
4. *Permendikbud 3 / 2020 tentang Standar Nasional Pendidikan Tinggi*
5. *Rector policy (Perek No. 17 / 2017) tentang Pedoman Evaluasi Kurikulum di Lingkungan Institut Teknologi Sepuluh Nopember (ITS)*

2. Vision, Missions, and Objective of Education (*Visi, Misi, dan Tujuan Pendidikan*)

2.1. Vision, Missions, and Objective of Faculty (*Visi, Misi, dan Tujuan Fakultas*)

Vision (*Visi*)

The Faculty of Intelligent Electrical and Informatics Technology vision is to become a reference faculty in education and research in the fields of electricity, electronics, information technology and computing-related fields with an international reputation and contributing to humanity.

Visi Fakultas Teknologi Elektro dan Informatika Cerdas adalah menjadi fakultas yang menjadi rujukan dalam pendidikan, dan penelitian di bidang kelistrikan, elektronika, teknologi informasi dan bidang terkait komputasi dengan reputasi internasional dan berkontribusi pada kemanusiaan..

Mission (*Misi*)

1. to carry out a higher education that qualifies international standards in developing science and technology in electrical, electronics, information technology and system, and computing-related fields,
menyelenggarakan pendidikan tinggi berstandar internasional dalam pengembangan ilmu pengetahuan dan teknologi di bidang kelistrikan, elektronika, sistem dan teknologi informasi, dan bidang yang berhubungan dengan komputasi,
2. to carry out continuous research and innovation of technologies in electrical and electronics fields, information technology and system, and computing-related fields,
melaksanakan penelitian berkelanjutan dan inovasi teknologi teknologi di bidang kelistrikan dan elektronika, sistem dan teknologi informasi, dan bidang yang berhubungan dengan komputasi,
3. to give real contribution for community, industry, and government through technology innovation in electrical and electronics fields, information technology and system, and computing-related fields,



Memberi kontribusi nyata kepada masyarakat, industri, dan pemerintah melalui inovasi teknologi di bidang teknologi kelistrikan dan elektronika, sistem dan teknologi informasi, dan bidang yang berhubungan dengan komputasi,

4. to manage faculties effectively and efficiently to support the implementation of the Tri Dharma of higher education,
mengelola fakultas secara efektif dan efisien untuk mendukung terlaksananya Tri Dharma perguruan tinggi,
5. to support link and match graduates by improving partnerships with industry, government, and community in national and international level,
mendukung link and match lulusan dengan meningkatkan kerjasama dengan industri, pemerintah dan masyarakat di tingkat nasional maupun internasional
6. to reinforce partnerships and international connections in the education field, research and innovation product improvement in international standard
memperkuat kerjasama dan jejaring internasional dalam bidang pendidikan, penelitian dan pengembangan produk inovasi yang bertaraf internasional,

Objective (Tujuan)

1. to produce environment and excellent academic atmosphere and able to facilitate academic staff to implement innovative and international standard teaching and learning process,
menciptakan lingkungan dan atmosfer akademis yang ekselen dan mampu memfasilitasi staff akademik untuk menerapkan proses belajar-mengajar yang inovatif dan berstandar internasional,
2. to produce education management in the F-ELECTICS that is efficient, effective, and sustainable and technology-based for excellent service to the entire academic community,
menciptakan manajemen pendidikan di lingkungan F-ELECTICS yang efisien, efektif, dan berkesinambungan dan berbasis teknologi untuk layanan yang prima kepada segenap civitas akademika,
3. to provide excellent service for all departments and study programs in the F-ELECTICS so that they are able to equip their graduates with the knowledge, skills and values necessary to be able to contribute and compete both at the national and international levels,
memberikan layanan prima untuk seluruh departemen dan program studi di lingkungan F-ELECTICS agar mampu membekali lulusannya dengan pengetahuan, keterampilan, dan tata nilai yang diperlukan agar mampu berkontribusi dan bersaing baik di tingkat nasional ataupun internasional,
4. to Increase productive and sustainable cooperation between national and international partner faculties in the field of education and the application of technology for humanity and the progress of the nation,
meningkatkan kerja sama yang produktif dan berkesinambungan antara fakultas mitra nasional dan internasional baik dalam bidang pendidikan dan penerapan teknologi untuk kemanusiaan dan kemajuan bangsa.

2.2. Vision, Missions, and Objective of Department (Visi, Misi, dan Tujuan Departemen)

Vision (Visi)

The Department of Informatics vision is to become an excellent education and research institution in informatics at the national level and have an international reputation.



Visi Departemen Informatika adalah menjadi inovator bidang informatika yang unggul di tingkat nasional dengan reputasi internasional, serta berperan aktif dalam upaya memajukan dan mensejahterakan bangsa.

Missions (Misi)

1. to carry out a high-quality learning process that qualifies national and international standards,
menyelenggarakan proses pembelajaran yang berkualitas, dan memenuhi standar nasional maupun internasional,
2. to carry out innovative, quality, and beneficial research,
melaksanakan penelitian yang inovatif, bermutu, dan bermanfaat,
3. to increase the use of information and communication technology for the community,
meningkatkan pemanfaatan teknologi informasi dan komunikasi untuk masyarakat,
4. to establish partnerships with various institutions, both in Indonesia and abroad.
menjalin kemitraan dengan berbagai lembaga, baik di dalam maupun di luar negeri.

Objective (Tujuan)

1. to educate students to be competent, competitive, and independent graduates to compete at national and international levels,
menghasilkan lulusan yang kompeten di bidang Informatika, serta memiliki daya saing dan kemandirian untuk berkompetisi di tingkat nasional dan internasional,
2. to keep on improving the learning process,
melakukan perbaikan proses pembelajaran secara berkesinambungan,
3. to produce innovative and beneficial research to the community and to publish the research in reputable national or international journals or conferences,
menghasilkan karya penelitian yang inovatif dan bermanfaat bagi masyarakat, serta publikasi di jurnal nasional ataupun internasional bereputasi,
4. to contribute to improving the quality of people's lives,
memberikan kontribusi bagi peningkatan mutu kehidupan masyarakat,
5. to take an active role in activities in the informatics field at the national and international levels.
mengambil peran aktif dalam kegiatan bidang Informatika pada tingkat nasional dan internasional.

2.3. Vision, Missions, and Objective of Master Degree Program (Visi, Misi, dan Tujuan Program Magister)

Vision (Visi)

The vision of Master of Informatics Program (MIP) is become a provider of quality master's education in the field of informatics and has a reputation for excellence in the fields of education, research and application of the informatics at the national and international levels.



Visi Program Magister Teknik Informatika adalah menjadi inovator bidang informatika yang unggul di tingkat nasional dengan reputasi internasional, serta berperan aktif dalam upaya memajukan dan mensejahterakan bangsa.

Mission (Misi)

1. to carry out a high-quality learning process that qualifies national and international standards,
menyelenggarakan proses pembelajaran yang berkualitas dan memenuhi standar nasional maupun internasional,
2. to carry out innovative, quality, and beneficial research,
melaksanakan penelitian yang inovatif, bermutu, dan bermanfaat.
3. to increase the use of information and communication technology for the community,
meningkatkan pemanfaatan teknologi informasi dan komunikasi untuk masyarakat,
4. to establish partnerships with various institutions, both in Indonesia and abroad.
Menjalin kemitraan dengan berbagai Lembaga, baik di dalam maupun di luar negeri.

Objective (Tujuan)

Table 1. Objective of MIP

No	Code of Objective <i>Kode Tujuan</i>	Description of Objective <i>Deskripsi Tujuan</i>
1	PEO-1	Educate and produce competent graduates as researchers, educators and professionals in the field of informatics who have superior abilities in designing, analyzing, and experimenting with computer-based systems.
2	PEO-2	Educating and producing graduates who have the ability to think critically, and innovatively , and have the ability to develop themselves through a lifelong learning process.
3	PEO-3	Educating and producing graduates who are competitive and independent to compete at the national and international levels in the field of informatics through the ability to conduct research and scientific publications.
4	PEO-4	Educate and produce graduates who are able to contribute to improving the quality of people's lives through the application of knowledge in the field of informatics in various fields.

3. Curriculum Evaluation & Tracer Study (*Evaluasi Kurikulum & Tracer Study*)

3.1. Curriculum Evaluation (*Evaluasi Kurikulum*)

Curriculum evaluation from formative evaluation and summative evaluation. Formative evaluation is carried out annually by the Course Clusters (RMK) with the contents of the Course Learning Design each initial semester. In addition, for parallel classes in each RMK, additional evaluations are carried out in the form of assignments given to students.

Evaluasi kurikulum terdiri dari evaluasi formative dan evaluasi summative. Evaluasi formative dilakukan setiap tahun oleh Rumpun Mata Kuliah (RMK) dengan mengevaluasi konten Rancangan

Pembelajaran Mata Kuliah setiap awal semester. Selain itu, bagi kelas-kelas yang paralel di tiap RMK, maka dilakukan tambahan evaluasi berupa penyamaan tugas yang diberikan ke mahasiswa.

3.2. Tracer Study (Tracer Study)

Figure 1 to Figure 3 shows a graph of the percentage of GPA of Master Informatics students and Master Informatics graduate jobs. Graph data obtained from data collection of respondents in the form of informatics student sampling. Based on these charts, Informatics students have the highest percentage of GPA between 3.5 and 3.75. Then, 96% of graduate jobs are in accordance with the Informatics field and 43% of graduate workplaces are national and 6% are multinational.

Gambar 1 sampai Gambar 3 menunjukkan grafik persentase IPK mahasiswa Master Teknik Informatika serta pekerjaan lulusan Master Teknik Informatika. Data grafik didapatkan dari pengambilan data responden berupa sampling mahasiswa Master Teknik Informatika. Berdasarkan grafik-grafik tersebut, mahasiswa Teknik Informatika memiliki prosentase tertinggi pada IPK antara 3.5 dan 3.75. Kemudian, 96% pekerjaan lulusan sudah sesuai dengan bidang Informatika serta 43% tempat kerja lulusan adalah nasional dan 6% pada multinasional.

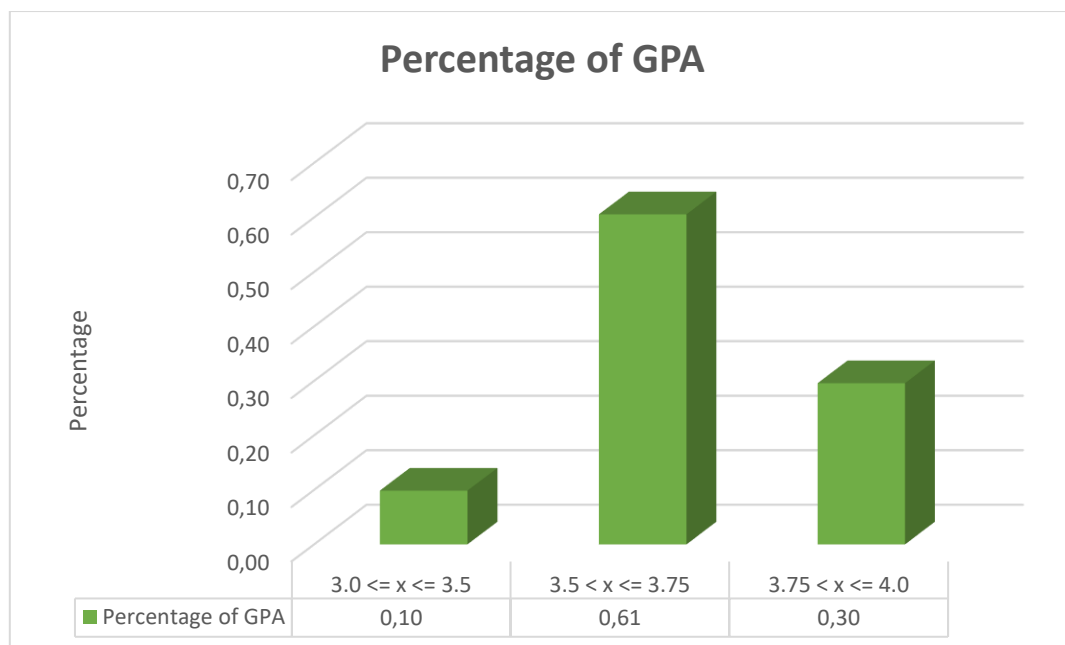


Figure 1. Percentage of Respondents' GPA

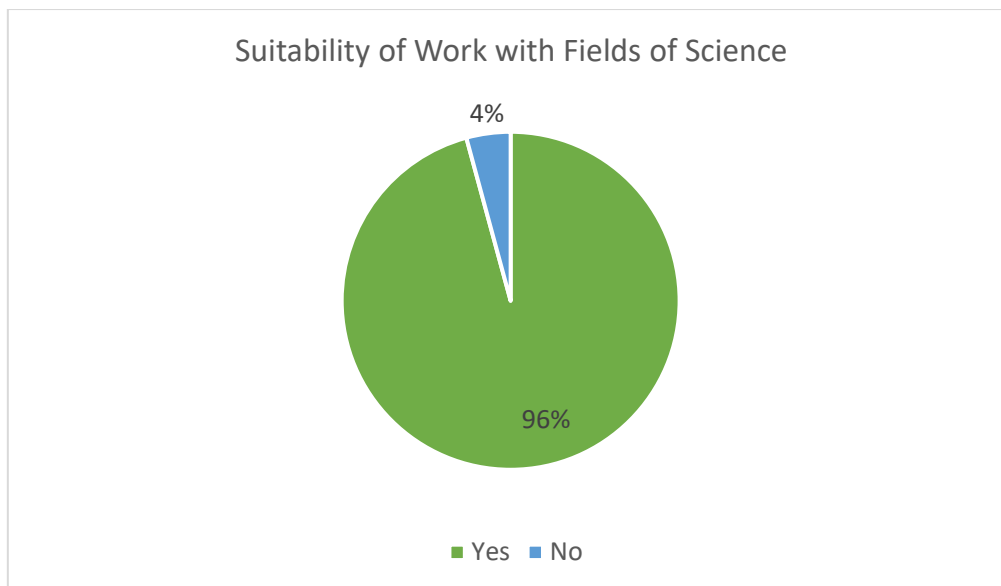


Figure 2. Suitability of Work with Fields of Science

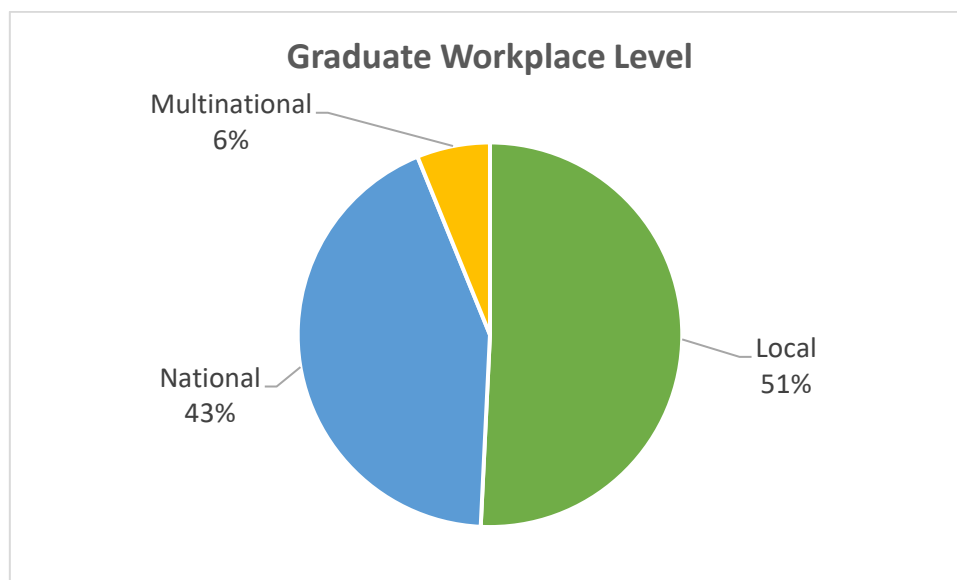


Figure 3. Graduate Workplace Level

4. Graduate Profiles & Program Learning Outcomes (*Profil Lulusan & Capaian Pembelajaran Lulusan*)

4.1. Graduate Profiles (*Profil Lulusan*)

The intended competence profile is determined based on general requirements in computer science graduates and professional works' expectations. The intended competence profiles are developed periodically every five years to enhance the quality of the graduates' profiles. The details of the BIP's graduate profiles are described in Table 2.

Profil kompetensi yang dimaksud ditentukan berdasarkan persyaratan umum lulusan ilmu komputer dan harapan pekerjaan profesional. Profil kompetensi yang dimaksud dikembangkan secara berkala setiap lima tahun sekali untuk meningkatkan kualitas profil lulusan. Rincian profil lulusan BIP dijelaskan pada Tabel 2.



Table 2. Graduate Profiles and Description

No	Graduate Profile <i>Profil Lulusan</i>	Description <i>Deskripsi</i>
1	Academics	Assisting a lecturer in providing teaching and supervision. <i>Membantu dosen dalam mengajar dan membimbing.</i>
2	Researcher	Conducting a research related to computer science knowledge. <i>Melakukan penelitian terkait pengetahuan ilmu komputer.</i>
3	Software Engineer/Developer	Applying extensive knowledge of programming languages, software development, and computer operating systems to software creation. <i>Menerapkan pengetahuan luas tentang bahasa pemrograman, pengembangan perangkat lunak, dan sistem operasi komputer untuk pembuatan perangkat lunak.</i>
4	System Analyst/Developer	Transforming user requests or requirements into technical design specifications and act as a liaison between clients / IT professionals and technology vendors. <i>Mentransformasi permintaan atau persyaratan pengguna menjadi spesifikasi desain teknis dan bertindak sebagai penghubung antara klien / profesional TI dan vendor teknologi.</i>
5	Computer Network Specialist	Maintaining the integrity of a network system by overseeing the supporting system, the delivery capacity of the system server, and the installed software. <i>Menjaga integritas sistem jaringan dengan mengawasi sistem pendukung, kapasitas pengiriman server sistem, dan perangkat lunak yang diinstal.</i>
6	Data Scientist	Extracting, analyzing and interpreting data using tools and methods from statistics and machine learning to produce the accurate information and valuable therefore can support decision making. <i>Mengekstraksi, menganalisis dan menginterpretasi data menggunakan perangkat dan metode statistik dan mesin pembelajaran untuk menghasilkan informasi yang akurat dan bernilai tinggi sehingga dapat membantu pengambilan keputusan.</i>
7	IT Consultant	Integrating information technology into businesses and showing clients how to use IT more efficiently to help reach objectives and targets. <i>Mengintegrasikan teknologi informasi ke dalam bisnis dan menunjukkan kepada klien bagaimana menggunakan TI secara lebih efisien untuk membantu mencapai tujuan dan target.</i>
8	Data Analyst	Identifying and communicating data-driven insights that allow managers, stakeholders, and other executives in an organization to make more informed decisions. <i>Mengidentifikasi dan mengomunikasikan wawasan berbasis data</i>



No	Graduate Profile <i>Profil Lulusan</i>	Description <i>Deskripsi</i>
		<i>yang memungkinkan manajer, pemangku kepentingan, dan eksekutif lain dalam organisasi untuk membuat keputusan yang lebih tepat.</i>
9	Software Project Manager	planning and monitoring projects including writing the project proposal, project cost estimation, scheduling, project staffing, software process tailoring, project monitoring and control, software configuration management, risk management, managerial report writing and presentation and interfacing with clients. <i>merencanakan dan memantau proyek termasuk penulisan proposal proyek, estimasi biaya proyek, penjadwalan, staf proyek, penyesuaian proses perangkat lunak, pemantauan dan pengendalian proyek, manajemen konfigurasi perangkat lunak, manajemen risiko, penulisan dan presentasi laporan manajerial dan interaksi dengan klien.</i>

4.2. Formulation PLO (*Perumusan CPL*)

Table 3. Program Learning Outcomes based on SN Dikti

No	Program Learning Outcomes <i>Capaian Pembelajaran Lulusan Program Studi</i>
ASPECTS OF ATTITUDE <i>ASPEK SIKAP</i>	
S1	Be devoted to God Almighty and able to show a religious attitude <i>Bertakwa kepada Tuhan Yang Maha Esa dan mampu menunjukkan sikap religious</i>
S2	Upholding human values in carrying out duties based on religion, morals and ethics <i>Menjunjung tinggi nilai kemanusiaan dalam menjalankan tugas berdasarkan agama, moral, dan etika</i>
S3	Contributing to improving the quality of life in society, nation, state, and advancement of civilization based on Pancasila <i>Berkontribusi dalam peningkatan mutu kehidupan bermasyarakat, berbangsa, bernegara, dan kemajuan peradaban berdasarkan Pancasila</i>
S4	Acting as citizens who are proud and love the country, have nationalism and a sense of responsibility to the state and nation <i>Berperan sebagai warga negara yang bangga dan cinta tanah air, memiliki nasionalisme serta rasa tanggung jawab pada negara dan bangsa</i>
S5	Respect the diversity of cultures, views, religions and beliefs, as well as the original opinions or findings of others <i>Menghargai keanekaragaman budaya, pandangan, agama, dan kepercayaan, serta pendapat atau temuan orisinal orang lain</i>
S6	Cooperate and have social sensitivity and care for society and the environment <i>Bekerjasama dan memiliki kepekaan sosial serta kepedulian terhadap masyarakat dan lingkungan</i>



No	Program Learning Outcomes <i>Capaian Pembelajaran Lulusan Program Studi</i>
	<i>lingkungan</i>
S7	Obeying laws and discipline in social and state life <i>Taat hukum dan disiplin dalam kehidupan bermasyarakat dan bernegara</i>
S8	Internalizing academic values, norms and ethics <i>Menginternalisasi nilai, norma, dan etika akademik</i>
S9	Demonstrate an attitude of responsibility for work in their field of expertise independently <i>Menunjukkan sikap bertanggungjawab atas pekerjaan di bidang keahliannya secara mandiri</i>
S10	Internalizing the spirit of independence, struggle, and entrepreneurship <i>Menginternalisasi semangat kemandirian, kejuangan, dan kewirausahaan</i>
S11	Earnestly tries to achieve a perfect result <i>Berusaha secara maksimal untuk mencapai hasil yang sempurna</i>
S12	Working together to be able to make the most of their potential <i>Bekerja sama untuk dapat memanfaatkan semaksimal mungkin potensi yang dimiliki</i>
GENERAL SKILLS ASPEK KETERAMPILAN UMUM	
KU1	Able to develop logical, critical, systematic, and creative thinking through scientific research, design creation or works of art in the field of science and technology that pay attention to and apply humanities values in accordance with their areas of expertise, compile scientific conceptions and study results based on rules, procedures, and scientific ethics in the form of a thesis or other equivalent form, and uploaded on the college website, as well as papers that have been published in accredited scientific journals or accepted in international journals <i>Mampu mengembangkan pemikiran logis, kritis, sistematis, dan kreatif melalui penelitian ilmiah, penciptaan desain atau karya seni dalam bidang ilmu pengetahuan dan teknologi yang memperhatikan dan menerapkan nilai humaniora sesuai dengan bidang keahliannya, menyusun konsepsi ilmiah dan hasil kajian berdasarkan kaidah, tata cara, dan etika ilmiah dalam bentuk tesis atau bentuk lain yang setara, dan diunggah dalam laman perguruan tinggi, serta makalah yang telah diterbitkan di jurnal ilmiah terakreditasi atau diterima di jurnal internasional</i>
KU2	Able to carry out academic validation or studies according to their field of expertise in solving problems in the relevant community or industry through the development of their knowledge and expertise <i>Mampu melakukan validasi akademik atau kajian sesuai bidang keahliannya dalam menyelesaikan masalah di masyarakat atau industri yang relevan melalui pengembangan pengetahuan dan keahliannya</i>
KU3	Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and communicate them through the media to the academic



No	Program Learning Outcomes <i>Capaian Pembelajaran Lulusan Program Studi</i>
	community and the wider community <i>Mampu menyusun ide, hasil pemikiran, dan argumen saintifik secara bertanggung jawab dan berdasarkan etika akademik, serta mengkomunikasikannya melalui media kepada masyarakat akademik dan masyarakat luas</i>
KU4	Able to identify the scientific field that becomes the object of his research and position it on a research map developed through an interdisciplinary or multidisciplinary approach <i>Mampu mengidentifikasi bidang keilmuan yang menjadi obyek penelitiannya dan memposisikan ke dalam suatu peta penelitian yang dikembangkan melalui pendekatan interdisiplin atau multidisiplin</i>
KU5	Able to make decisions in the context of solving problems in the development of science and technology that pay attention to and apply humanities values based on analytical or experimental studies of information and data <i>Mampu mengambil keputusan dalam konteks menyelesaikan masalah pengembangan ilmu pengetahuan dan teknologi yang memperhatikan dan menerapkan nilai humaniora berdasarkan kajian analisis atau eksperimental terhadap informasi dan data</i>
KU6	Able to manage, develop and maintain networks with colleagues, peers within the wider research institute and community <i>Mampu mengelola, mengembangkan dan memelihara jaringan kerja dengan kolega, sejawat di dalam lembaga dan komunitas penelitian yang lebih luas</i>
KU7	Able to increase learning capacity independently <i>Mampu meningkatkan kapasitas pembelajaran secara mandiri</i>
KU8	Able to document, store, secure, and recover research data in order to ensure validity and prevent plagiarism <i>Mampu mendokumentasikan, menyimpan, mengamankan, dan menemukan kembali data hasil penelitian dalam rangka menjamin kesahihan dan mencegah plagiasi</i>
KU9	Able to develop themselves and compete at the national and international levels <i>Mampu mengembangkan diri dan bersaing di tingkat nasional maupun internasional</i>
KU10	Able to implement the principle of sustainability in developing knowledge <i>Mampu mengimplementasikan prinsip keberlanjutan (sustainability) dalam mengembangkan pengetahuan</i>
KU11	Able to implement information and communication technology in the context of the implementation of their work <i>Mampu mengimplementasikan teknologi informasi dan komunikasi dalam konteks pelaksanaan pekerjaannya</i>
SPECIAL SKILLS ASPEK KETRAMPILAN KHUSUS	
KK1	Able to develop applications by applying the principles of smart systems and computational science to produce smart application products in various fields and



No	Program Learning Outcomes <i>Capaian Pembelajaran Lulusan Program Studi</i>
	scientific disciplines <i>Mampu mengembangkan aplikasi dengan menerapkan prinsip-prinsip sistem cerdas dan ilmu komputasi untuk menghasilkan produk aplikasi cerdas pada berbagai bidang dan disiplin keilmuan</i>
KK2	Able to model computer architecture and operating system working principles for the development and management of network systems that have high performance, are safe and efficient <i>Mampu memodelkan arsitektur komputer serta prinsip-prinsip kerja sistem operasi untuk pengembangan dan pengelolaan sistem jaringan yang mempunyai kinerja tinggi, aman, dan efisien</i>
KK3	Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields and scientific disciplines <i>Mampu mengembangkan konsep komputasi berbasis jaringan, komputasi paralel, komputasi terdistribusi untuk menganalisa dan merancang algoritma penyelesaian masalah komputasi di dalam berbagai bidang dan disiplin keilmuan</i>
KK4	Able to model, analyze and develop software using software engineering process principles to produce software that meets both technical and managerial quality <i>Mampu memodelkan, menganalisa dan mengembangkan perangkat lunak dengan menggunakan prinsip-prinsip proses rekayasa perangkat lunak untuk menghasilkan perangkat lunak yang memenuhi kualitas baik secara teknis dan manajerial</i>
KK5	Able to model, analyze and develop applications using the principles of computer graphics including modeling, rendering, animation and visualization, as well as applying the principles of human and computer interaction and evaluating the efficiency of building applications with a suitable interface <i>Mampu memodelkan, menganalisa dan mengembangkan aplikasi menggunakan prinsip-prinsip grafika komputer meliputi pemodelan, rendering, animasi dan visualisasi, serta menerapkan prinsip-prinsip interaksi manusia dan komputer serta melakukan evaluasi ketepatangunaan untuk membangun aplikasi dengan antar muka yang sesuai</i>
KK6	Able to model, analyze and develop computational problem solving and mathematical modeling through exact, stochastic, probabilistic and numerical approaches effectively and efficiently <i>Mampu memodelkan, menganalisa dan mengembangkan penyelesaian persoalan komputasi dan pemodelan matematis melalui pendekatan eksak, stokastik, probabilistik dan numerik secara efektif dan efisien</i>
KK7	Able to develop techniques and algorithms for collecting, digitizing, representing, transforming, and presenting information, for efficient and effective information access <i>Mampu mengembangkan teknik dan algoritma pengumpulan, digitalisasi, representasi, transformasi, dan penyajian informasi, untuk pengaksesan informasi yang efisien dan efektif</i>



No	Program Learning Outcomes Capaian Pembelajaran Lulusan Program Studi
KK8	Able to model, analyze and develop algorithms to solve problems effectively and efficiently based on strong programming principles, and be able to apply programming models that underlie various existing programming languages, and be able to choose a programming language to produce suitable applications <i>Mampu memodelkan, menganalisa dan mengembangkan algoritma untuk menyelesaikan permasalahan secara efektif dan efisien berdasarkan kaidah-kaidah pemrograman yang kuat, serta mampu mengaplikasikan model-model pemrograman yang mendasari berbagai bahasa pemrograman yang ada, serta mampu memilih bahasa pemrograman untuk menghasilkan aplikasi yang sesuai</i>
MASTER OF KNOWLEDGE ASPEK PENGETAHUAN	
P1	Mastering intelligent system application theory and theory which includes representational and reasoning techniques, search techniques, intelligent agents, data mining, and machine learning, as well as intelligent application development in various fields, and master the concepts and principles of computational science including information management, data processing multimedia, and numerical analysis <i>Menguasai teori dan teori aplikasi sistem cerdas yang meliputi teknik representasi dan penalaran, teknik pencarian, agen cerdas, penggalian data, dan pembelajaran mesin, serta pengembangan aplikasi cerdas pada berbagai bidang, serta menguasai konsep dan prinsip-prinsip ilmu komputasi meliputi pengelolaan informasi, pengolahan data multimedia, dan analisis numerik</i>
P2	Mastering theory and application theory as well as architectural principles and computer networks <i>Menguasai teori dan teori aplikasi serta prinsip arsitektur dan jaringan komputer</i>
P3	Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security <i>Menguasai teori dan teori aplikasi tentang komputasi berbasis jaringan dan teknologi terkini yang terkait dengannya, di bidang komputasi terdistribusi dan komputasi bergerak, komputasi multimedia, komputasi berkinerja tinggi serta keamanan informasi dan jaringan</i>
P4	Mastering theory and application theory in software design and development with standard and scientific methods of planning, requirements engineering, designing, implementing, testing, and launching, to produce software products that meet various technical and managerial quality parameters, and are useful in development software <i>Menguasai teori dan teori aplikasi dalam perancangan dan pembangunan perangkat lunak dengan metode perencanaan, rekayasa kebutuhan, perancangan, pengimplementasian, pengujian, dan peluncuran yang baku dan ilmiah, untuk menghasilkan produk perangkat lunak yang memenuhi berbagai parameter kualitas secara teknis maupun manajerial, dan berdayaguna dalam pengembangan perangkat lunak</i>



No	Program Learning Outcomes <i>Capaian Pembelajaran Lulusan Program Studi</i>
P5	Mastering the theory and theory of computer graphics applications including modeling, rendering, animation and visualization, as well as mastering the theory and application theory of human and computer interactions <i>Menguasai teori dan teori aplikasi grafika komputer meliputi pemodelan, rendering, animasi dan visualisasi, serta menguasai teori dan teori aplikasi dari interaksi manusia dan komputer</i>
P6	Mastering theory and application theory for solving computational problems using linear and non-linear optimization as well as modeling and simulation <i>Menguasai teori dan teori aplikasi untuk penyelesaian permasalahan komputasi dengan menggunakan optimasi liner dan non linear serta pemodelan dan simulasi</i>
P7	Mastering theory and application theory for the development of the process of gathering, processing and storing information in various forms <i>Menguasai teori dan teori aplikasi untuk pengembangan proses pengumpulan, pengolahan dan penyimpanan informasi dalam berbagai bentuk format</i>
P8	Mastering the theory and application theory in algorithm development in various programming language concepts <i>Menguasai teori dan teori aplikasi dalam pengembangan algoritma pada berbagai macam konsep bahasa pemrograman</i>

Table 4. Program Learning Outcomes

No	Description of PLO
PLO-IF-1	Able to improve intelligent system concepts and computational science to produce intelligent applications in various scientific fields and disciplines <i>Mampu untuk memperbaiki konsep sistem cerdas dan ilmu komputasi untuk menghasilkan aplikasi cerdas aplikasi pada berbagai bidang dan disiplin</i>
PLO-IF-2	Able to improve network architecture concepts and network-based computing principles with high performance and security <i>Mampu untuk memperbaiki konsep arsitektur jaringan dan prinsip komputasi berbasis jaringan yang mempunyai kinerja tinggi dan aman</i>
PLO-IF-3	Able to analyze and improve software quality both technically and managerial by using software engineering processes principles <i>Mampu untuk menganalisis dan memperbaiki kualitas perangkat lunak baik secara teknis dan manajerial dengan menggunakan prinsip-prinsip proses rekayasa perangkat lunak</i>
PLO-IF-4	Able to model and improve computer graphics principles as well as human and computer interactions in software development <i>Mampu untuk memodelkan dan memperbaiki prinsip-prinsip grafika komputer serta interaksi manusia dan computer dalam pengembangan perangkat lunak</i>
PLO-IF-5	Able to analyze and improve computational problem solving through



No	Description of PLO
	modeling with exact, numerical, and probabilistic approaches effectively and efficiently <i>Mampu untuk menganalisis dan memperbaiki penyelesaian persoalan komputasi dan pemodelan matematis melalui pendekatan eksak, numerik, dan probabilistik secara efektif dan efisien</i>
PLO-IF-6	Able to improve methods for managing data and information in various forms <i>Mampu untuk memperbaiki metode untuk mengelola data dan informasi dalam berbagai bentuk format</i>
PLO-IF-7	Internalize values, norms, and academic ethics and demonstrate an independent attitude of responsibility for work in their field of expertise <i>Menginternalisasi nilai, norma, dan etika akademik dan menunjukkan sikap yang mandiri pada tanggungjawab dalam pekerjaan dalam bidang keahlian terkait</i>
PLO-IF-8	Able to work and communicate effectively both individually and in groups <i>Mampu bekerja dan berkomunikasi secara efektif baik secara individu maupun dalam kelompok</i>
PLO-IF-9	Able to improve logical, critical, systematic, and creative thinking through scientific research in the field of science and technology-based on scientific principles, procedures, and ethics in the form of theses and papers published in seminars or scientific journals at both national and international levels <i>Mampu untuk memperbaiki berpikir logik, kritis, sistematis, dan kreatif melalui penelitian ilmiah pada bidang keilmuan dan teknologi berdasarkan prinsip ilmiah, prosedur, dan etika dalam bentuk tesis dan artikel yang dipublikasikan di seminar atau jurnal ilmiah pada level nasional dan internasional.</i>

Table 5. Program Learning Outcomes (PLO) based on SN Dikti to Program Learning Outcomes (PLO)

SN DIKTI/PLO	PLO-IF-1	PLO-IF-2	PLO-IF-3	PLO-IF-4	PLO-IF-5	PLO-IF-6	PLO-IF-7	PLO-IF-8	PLO-IF-9
S1							√		
S2							√		
S3							√		
S4							√		
S5							√		
S6								√	
S7							√		
S8							√		
S9							√		
S10							√		
S11							√		
S12								√	
KU1									



SN DIKTI/PLO	PLO- IF-1	PLO- IF-2	PLO- IF-3	PLO- IF-4	PLO- IF-5	PLO- IF-6	PLO- IF-7	PLO- IF-8	PLO- IF-9
KU2									√
KU3									√
KU4									√
KU5									√
KU6									√
KU7									√
KU8									√
KU9									√
KU10									√
KU11									√
KK1	√								
KK2		√							
KK3		√							
KK4			√						
KK5				√					
KK6					√				
KK7						√			
KK8			√						
P1	√								
P2		√							
P3		√							
P4			√						
P5				√					
P6					√				
P7						√			
P8			√						

4.3. Relationship Matix of PLO and Graduate Profiles (*Matrik Hubungan CPL dengan Profil Lulusan*)

Table 6. Relationship of PLO and Graduate Profiles

Profile	Lecturer	Researcher	Software Engineer/ Developer	System Analyst/ Developer	Computer Network Specialist	Data Scientist	IT Consultant	Data Analyst	Software Project Manager
1	x	x	x	x		x	x		x
2	x	x		x	x		x		
3	x	x	x	x		x	x	x	x
4	x	x	x	x			x		x
5	x	x				x		x	
6	x	x	x			x	x	x	x
7	x	x	x	x			x		x
8	x	x	x	x	x	x	x	x	x
9	x	x	x	x	x	x	x	x	x



4.4. Relationship Matix of PLO and Objective of Master of Informatics Program (Matrik Hubungan CPL dengan Tujuan Program Studi Magister)

Table 7. Relationship of PLO and Objective of Master Program

Profile PLO	PEO-1	PEO-2	PEO-3	PEO-4
PLO-IF-1	√	√	√	√
PLO-IF-2	√	√	√	√
PLO-IF-3	√	√	√	√
PLO-IF-4	√	√	√	√
PLO-IF-5	√	√	√	√
PLO-IF-6	√	√	√	√
PLO-IF-7				√
PLO-IF-8	√	√		
PLO-IF-9			√	

5. Determination of Course Material (*Penentuan Bahan Kajian*)

5.1. Description of Body of Knowledge (*Gambaran Tubuh Pengetahuan*)

Curriculum of Master of Informatics Program (MIP) is arranged based on ACM Computer Science 2013, which are:

Kurikulum Program Magister Teknik Informatika disusun berdasarkan ACM Computer Science 2013, dengan rincian sebagai berikut:

1. AL - Algorithms and Complexity
2. AR - Architecture and Organization
3. CN - Computational Science
4. DS - Discrete Structures
5. GV - Graphics and Visual Computing
6. HCI - Human-Computer Interaction
7. IAS - Information Assurance and Security
8. IM - Information Management
9. IS - Intelligent Systems
10. NC- Networking and Communications
11. OS - Operating Systems
12. PBD - Platform-based Development
13. PD - Parallel and Distributed Computing
14. PL - Programming Languages
15. SDF - Software Development Fundamentals
16. SE - Software Engineering
17. SF - Systems Fundamentals
18. SP - Social and Professional Issues

Table 8. Course Material based on PLO

Description of PLO (<i>Deskripsi CPL</i>)		Course Material (<i>Bahan Kajian</i>)
PLO-IF-1	Able to improve intelligent system concepts and	Computational Intelligence IS/Basic Machine Learning



Description of PLO (<i>Deskripsi CPL</i>)		Course Material (<i>Bahan Kajian</i>)
	computational science to produce intelligent applications in various scientific fields and disciplines	IS/Advanced Machine Learning Topics In Data Mining CN/Data, Information, and Knowledge IM/Data Mining IS/Advanced Machine Learning Topics in Digital Image Processing IS/Perception and Computer Vision Topics In Information Retrieval Systems CN/Data, Information, and Knowledge IM/Information Storage and Retrieval Topics In Computer Vision IS/Perception and Computer Vision IS/Advanced Machine Learning
PLO-IF-2	Able to improve network architecture concepts and network-based computing principles with high performance and security	Topics in Cloud Computing IAS/Threats and Attacks IAS/Platform Security NC/Reliable Data Delivery NC/Resource Allocation OS/Virtual Machines OS/Fault Tolerance PD/Distributed Systems PD/Cloud Computing Operating Systems OS/Overview of Operating Systems OS/Operating System Principles OS/Scheduling and Dispatch OS/Memory Management OS/Security and Protection OS/Virtual Machines OS/File Systems OS/Fault Tolerance Topics In Network Design and Auditing IAS/Foundational Concepts in Security IAS/Principles of Secure Design IAS/Defensive Programming IAS/Threats and Attacks IAS/Network Security IAS/Web Security



Description of PLO (<i>Deskripsi CPL</i>)		Course Material (<i>Bahan Kajian</i>)
		IAS/Platform Security IAS/Security Policy and Governance Topics in Multimedia Networks IAS/Threats and Attacks IM/Multi Media Systems NC/Networked Applications NC/Reliable Data Delivery NC/Resource Allocation Topics in Distribution Systems AL/Algorithmic Strategies NC/Network end Applications NC/Reliable Data Delivery NC/Resource Allocation OS/Scheduling and Dispatch OS/Virtual Machines OS/RealTime and Embedded Systems PD/Communication and Coordination PD/Parallel Algorithms, Analysis, and Programming PD/Parallel Performance PD/Distributed Systems Topics in Network Security IAS/Principles of Secure Design IAS/Defensive Programming IAS/Threats and Attacks IAS/Network Security IAS/Web Security IAS/Platform Security Topics In Digital Forensics IAS/Web Security IAS/Digital Forensics IAS/Secure Software Engineering Topics In Wireless Networks NC/Networked Applications NC/Reliable Data Delivery NC/Routing & Forwarding NC/Local Area Networks NC/Resource Allocation
PLO-	Able to model, analyze, and	Software Engineering,



Description of PLO (Deskripsi CPL)		Course Material (Bahan Kajian)
IF-3	improve software quality both technically and managerial by using software engineering processes principles	SE/Software Design Topics in Parallel Computing and High Performance PD/Parallelism Fundamentals PD/Parallel Decomposition PD/Communication and Coordination PD/Parallel Algorithms, Analysis, & Programming PD/Parallel Architecture PD/Parallel Performance PL/Concurrent and Parallelism Topics in Mobile Computing, NC/Networked Applications NC/Reliable Data Delivery NC/Mobility PD/Communication and Coordination PD/Distributed Systems Topics In OT Evolution SE/Software Evolution Topics in OT Quality Assurance SE/Software Verification and Validation Topics in OT Economics SP/Economies of Computing Topics in Completion of OT Processes SE/Software Processes SE/Software Project Management Topics in Requirements Engineering SE/Requirements Engineering Topics in OT Project Management SE/Software Processes SE/Software Project Management SE/Requirements Engineering SE/Software Construction
PLO-IF-4	Able to model and improve computer graphics principles as well as human and computer interactions in software	Topics in Topics in Human and Computer Interaction HCI/Designing Interaction HCI/User-Centered Design & Testing HCI/Human Factors & Security



Description of PLO (Deskripsi CPL)		Course Material (Bahan Kajian)
	development	Topics in Game Development HCI/New Interactive Technologies GV/Visualization PBD/Game Platforms Topics in Virtual Reality HCI/Mixed, Augmented and Virtual Reality Topics in Computer Graphics GV/Fundamental Concepts GV/Basic Rendering GV/Geometric Modeling GV/Advanced Rendering GV/Computer Animation GV/Visualization
PLO-IF-5	Able to analyze and improve computational problem solving through modeling with exact, numerical, and probabilistic approaches effectively and efficiently	Topics in Modeling and Simulation AL/Algorithmic Strategies CN/Introduction to Modeling and Simulation CN/Modeling and Simulation CN/Processing Topics in Optimization Techniques AL/Algorithmic Strategies CN/Processing CN/Numerical Analysis
PLO-IF-6	Able to improve methods for managing data and information in various forms	Topics In Knowledge-Based Systems Engineering IM/Database Systems IM/Relational Databases IM/Data Mining IM/Information Storage and Retrieval Topics In System Audit IM/Transaction Processing IM/Data Mining IM/Information Storage and Retrieval Topics In Business Process Response Information Systems IM/Information Management Concepts IM/Data Modeling IM/Transaction Processing
PLO-IF-7	Internalize values, norms, and academic ethics and demonstrate an	Topics in Programming Language PBD/Introduction PBD/Mobile Platforms



Description of PLO (Deskripsi CPL)		Course Material (Bahan Kajian)
	independent attitude of responsibility for work in their field of expertise	Topics in Algorithm Design AL/Basic Analysis AL/Algorithmic Strategies AL/Fundamental Data Structures and Algorithms AL/Basic Automata, Computability and Complexity AL/Advanced Computational Complexity AL/Advanced Automata Theory and Computability AL/Advanced Data Structures, Algorithms, and Analysis
PLO-IF-8	Able to work and communicate effectively both individually and in groups	
PLO-IF-9	Able to improve logical, critical, systematic, and creative thinking through scientific research in the field of science and technology-based on scientific principles, procedures, and ethics in the form of theses and papers published in seminars or scientific journals at both national and international levels	Research Methodology Research Methodology Pre Thesis & Thesis Thesis

5.2. Description of Course Material (*Gambaran Bahan Kajian*)

Table 9. Course Material (*Bahan Kajian*)

No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
1.	IS/Basic Machine Learning	• Definition and examples of broad variety of machine learning tasks, including classification • Inductive learning • Simple statistical-based learning, such as Naive Bayesian Classifier, decision trees • The over-fitting problem • Measuring classifier accuracy
2.	IS/Advanced Machine Learning	• Definition and examples of broad variety of machine learning tasks



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• General statistical-based learning, parameter estimation (maximum likelihood) • Inductive logic programming (ILP) • Supervised learning - o Learning decision trees - o Learning neural networks - o Support vector machines (SVMs) • Ensembles • Nearest-neighbor algorithms • Unsupervised Learning and clustering - o EM - o K-means - o Self-organizing maps • Semi-supervised learning • Learning graphical models (Cross-reference IS/Reasoning under Uncertainty) • Performance evaluation (such as cross-validation, area under ROC curve) • Learning theory • The problem of overfitting, the curse of dimensionality • Reinforcement learning - o Exploration vs. exploitation trade-off - o Markov decision processes - o Value and policy iteration • Application of Machine Learning algorithms to Data Mining (cross-reference IM/Data Mining)
3.	CN/Data, Information, and Knowledge	• Content management models, frameworks, systems, design methods (as in IM. Information Management) • Digital representations of content including numbers, text, images (e.g., raster and vector), video (e.g., QuickTime, MPEG2, MPEG4), audio (e.g., written score, MIDI, sampled digitized sound track) and animations; complex/composite/aggregate objects; FRBR • Digital content creation/capture and preservation, including digitization, sampling, compression, conversion, transformation/translation, migration/emulation, crawling, harvesting • Content structure / management, including digital libraries and static/dynamic/stream aspects for: - o Data: data structures, databases - o Information: document collections, multimedia pools, hyperbases (hypertext, hypermedia), catalogs, repositories - o Knowledge: ontologies, triple stores, semantic networks, rules • Processing and pattern recognition, including indexing, searching (including: queries and query languages; central / federated / P2P), retrieving, clustering, classifying/categorizing, analyzing/mining/extracting, rendering, reporting, handling transactions • User / society support for presentation and interaction,



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		including browse, search, filter, route, visualize, share, collaborate, rate, annotate, personalize, recommend • Modeling, design, logical and physical implementation, using relevant systems/software
4. 4	IM/Data Mining	• Uses of data mining • Data mining algorithms • Associative and sequential patterns • Data clustering • Market basket analysis • Data cleaning • Data visualization (cross-reference GV/Visualization and CN/Interactive Visualization)
5. 5	IS/Perception and Computer Vision	• Computer vision - o Image acquisition, representation, processing and properties - o Shape representation, object recognition and segmentation - o Motion analysis • Audio and speech recognition • Modularity in recognition • Approaches to pattern recognition (cross-reference IS/Advanced Machine Learning) - o Classification algorithms and measures of classification quality - o Statistical techniques
6. 6	IM/Information Storage and Retrieval	• Documents, electronic publishing, markup, and markup languages • Tries, inverted files, PAT trees, signature files, indexing • Morphological analysis, stemming, phrases, stop lists • Term frequency distributions, uncertainty, fuzziness, weighting • Vector space, probabilistic, logical, and advanced models • Information needs, relevance, evaluation, effectiveness • Thesauri, ontologies, classification and categorization, metadata • Bibliographic information, bibliometrics, citations • Routing and (community) filtering • Multimedia search, information seeking behavior, user modeling, feedback • Information summarization and visualization • Faceted search (e.g., using citations, keywords, classification schemes) • Digital libraries • Digitization, storage, interchange, digital objects, composites, and packages • Metadata and cataloging • Naming, repositories, archives • Archiving and preservation, integrity • Spaces (conceptual, geographical, 2/3D, VR) • Architectures (agents, buses, wrappers/mediators),



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		interoperability • Services (searching, linking, browsing, and so forth) • Intellectual property rights management, privacy, and protection (watermarking)
7.	IAS/Threats and Attacks	• Attacker goals, capabilities, and motivations (such as underground economy, digital espionage, cyberwarfare, insider threats, hacktivism, advanced persistent threats) • Examples of malware (e.g., viruses, worms, spyware, botnets, Trojan horses or rootkits) • Denial of Service (DoS) and Distributed Denial of Service (DDoS) • Social engineering (e.g., phishing) (cross-reference SP/Social Context/Social implications of computing in a networked world and HCI/Designing Interaction/Handling human/system failure)
8.	IAS/Platform Security	• Code integrity and code signing • Secure boot, measured boot, and root of trust • Attestation • TPM and secure co-processors • Security threats from peripherals, e.g., DMA, IOMMU • Physical attacks: hardware Trojans, memory probes, cold boot attacks • Security of embedded devices, e.g., medical devices, cars • Trusted path
9.	NC/Reliable Data Delivery	• Error control (retransmission techniques, timers) • Flow control (acknowledgements, sliding window) • Performance issues (pipelining) • TCP
10.	NC/Resource Allocation	• Need for resource allocation • Fixed allocation (TDM, FDM, WDM) versus dynamic allocation • End-to-end versus network assisted approaches • Fairness • Principles of congestion control • Approaches to Congestion (e.g., Content Distribution Networks)
11.	OS/Virtual Machines	• Types of virtualization (including Hardware/Software, OS, Server, Service, Network) • Paging and virtual memory • Virtual file systems • Hypervisors • Portable virtualization; emulation vs. isolation • Cost of virtualization
12.	OS/Fault Tolerance	• Fundamental concepts: reliable and available systems (cross-reference SF/Reliability through Redundancy) • Spatial and temporal redundancy (cross-reference SF/Reliability through Redundancy)



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• Methods used to implement fault tolerance • Examples of OS mechanisms for detection, recovery, restart to implement fault tolerance, use of these techniques for the OS's own services
13.	PD/Distributed Systems	• Faults (cross-reference OS/Fault Tolerance) - o Network-based (including partitions) and node-based failures - o Impact on system-wide guarantees (e.g., availability) • Distributed message sending - o Data conversion and transmission - o Sockets - o Message sequencing - o Buffering, retrying, and dropping messages • Distributed system design tradeoffs - o Latency versus throughput - o Consistency, availability, partition tolerance • Distributed service design - o Stateful versus stateless protocols and services - o Session (connection-based) designs - o Reactive (IO-triggered) and multithreaded designs • Core distributed algorithms - o Election, discovery
14.	PD/Cloud Computing	• Internet-Scale computing - o Task partitioning (cross-reference PD/Parallel Algorithms, Analysis, and Programming) - o Data access - o Clusters, grids, and meshes • Cloud services - o Infrastructure as a service □ Elasticity of resources □ Platform APIs - o Software as a service - o Security - o Cost management • Virtualization (cross-reference SF/Virtualization and Isolation and OS/Virtual Machines) - o Shared resource management - o Migration of processes • Cloud-based data storage - o Shared access to weakly consistent data stores - o Data synchronization - o Data partitioning - o Distributed file systems (cross-reference IM/Distributed Databases) - o Replication
15.	OS/Overview of Operating Systems	• Role and purpose of the operating system • Functionality of a typical operating system • Mechanisms to support client-server models, hand-held devices • Design issues (efficiency, robustness, flexibility,



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		portability, security, compatibility) • Influences of security, networking, multimedia, windowing systems
16.	OS/Operating System Principles	• Structuring methods (monolithic, layered, modular, micro-kernel models) • Abstractions, processes, and resources • Concepts of application program interfaces (APIs) • The evolution of hardware/software techniques and application needs • Device organization • Interrupts: methods and implementations • Concept of user/system state and protection, transition to kernel mode
17.	OS/Memory Management	• Review of physical memory and memory management hardware • Working sets and thrashing • Caching (cross-reference AR/Memory System Organization and Architecture)
18.	OS/Security and Protection	• Overview of system security • Policy/mechanism separation • Security methods and devices • Protection, access control, and authentication • Backups
19.	OS/FileSystems	• Files: data, metadata, operations, organization, buffering, sequential, nonsequential • Directories: contents and structure • File systems: partitioning, mount/unmount, virtual file systems • Standard implementation techniques • Memory-mapped files • Special-purpose file systems • Naming, searching, access, backups • Journaling and log-structured file systems
20.	IAS/Foundational Concepts in Security	• CIA (Confidentiality, Integrity, Availability) • Concepts of risk, threats, vulnerabilities, and attack vectors (cross-reference SE/Software Project Management/Risk) • Authentication and authorization, access control (mandatory vs. discretionary) • Concept of trust and trustworthiness • Ethics (responsible disclosure). (cross-reference SP/Professional Ethics/Accountability, responsibility and liability)
21.	IAS/Principles of Secure Design	• Least privilege and isolation (cross-reference OS/Security and Protection/Policy/mechanism separation and SF/Virtualization and Isolation/Rationale for protection and predictable performance and PL/Language Translation and Execution/Memory management)



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• Fail-safe defaults (cross-reference SE/Software Construction/ Coding practices: techniques, idioms/patterns, mechanisms for building quality programs and SDF/Development Methods/Programming correctness) • Open design (cross-reference SE/Software Evolution/ Software development in the context of large, preexisting code bases) • End-to-end security (cross-reference SF/Reliability through Redundancy/ How errors increase the longer the distance between the communicating entities; the end-to-end principle) • Defense in depth (e.g., defensive programming, layered defense) • Security by design (cross-reference SE/Software Design/System design principles) • Tensions between security and other design goals
22.	IAS/Defensive Programming	[Core-Tier1] • Input validation and data sanitization (cross-reference SDF/Development Methods/Program Correctness) • Choice of programming language and type-safe languages • Examples of input validation and data sanitization errors (cross-reference SDF/Development Methods/Program Correctness and SE/Software Construction/Coding Practices) - o Buffer overflows - o Integer errors - o SQL injection - o XSS vulnerability • Race conditions (cross-reference SF/Parallelism/Parallel programming and PD/Parallel Architecture/Shared vs. distributed memory and PD/Communication and Coordination/Shared Memory and PD/Parallelism Fundamentals/Programming errors not found in sequential programming) • Correct handling of exceptions and unexpected behaviors (cross-reference SDF/Development Methods/program correctness) [Core-Tier2] • Correct usage of third-party components (cross-reference SDF/Development Methods/program correctness and Operating System Principles/Concepts of application program interfaces (APIs) • Effectively deploying security updates (cross-reference OS/Security and Protection/Security methods and devices) [Electives] • Information flow control • Correctly generating randomness for security purposes



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• Mechanisms for detecting and mitigating input and data sanitization errors • Fuzzing • Static analysis and dynamic analysis • Program verification • Operating system support (e.g., address space randomization, canaries) • Hardware support (e.g., DEP, TPM)
23.	IAS/Network Security	[Core-Tier2] • Network specific threats and attack types (e.g., denial of service, spoofing, sniffing and traffic redirection, man-in-the-middle, message integrity attacks, routing attacks, and traffic analysis) • Use of cryptography for data and network security • Architectures for secure networks (e.g., secure channels, secure routing protocols, secure DNS, VPNs, anonymous communication protocols, isolation) • Defense mechanisms and countermeasures (e.g., network monitoring, intrusion detection, firewalls, spoofing and DoS protection, honeypots, tracebacks) . [Elective] • Security for wireless, cellular networks (cross-reference NC/Mobility/Principles of cellular networks; cross-reference NC/Mobility/802.11) • Other non-wired networks (e.g., ad hoc, sensor, and vehicular networks) • Censorship resistance • Operational network security management (e.g., configure network access control)
24.	IAS/Web Security	• Web security model - o Browser security model including same-origin policy - o Client-server trust boundaries, e.g., cannot rely on secure execution in the client • Session management, authentication - o Single sign-on - o HTTPS and certificates • Application vulnerabilities and defenses - o SQL injection - o XSS - o CSRF • Client-side security - o Cookies security policy - o HTTP security extensions, e.g. HSTS - o Plugins, extensions, and web apps - o Web user tracking • Server-side security tools, e.g. Web Application Firewalls (WAFs) and fuzzers
25.	IAS/Security Policy and Governance	• Privacy policy (cross-reference SP/Social Context/Social implications of computing in a networked world; cross-reference SP/Professional Ethics/Accountability,



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		responsibility and liability; cross-reference SP/Privacy and Civil Liberties/Legal foundations of privacy protection) • Inference controls/statistical disclosure limitation • Backup policy, password refresh policy • Breach disclosure policy • Data collection and retention policies • Supply chain policy • Cloud security tradeoffs
26.	NC/Networked Applications	• Naming and address schemes (DNS, IP addresses, Uniform Resource Identifiers, etc.) • Distributed applications (client/server, peer-to-peer, cloud, etc.) • HTTP as an application layer protocol • Multiplexing with TCP and UDP • Socket APIs
27.	AL/Algorithmic Strategies	[Core-Tier1] • Brute-force algorithms • Greedy algorithms • Divide-and-conquer (cross-reference SDF/Algorithms and Design/Problem-solving strategies) • Recursive backtracking • Dynamic Programming [Core-Tier2] • Branch-and-bound • Heuristics • Reduction: transform-and-conquer
28.	PD/Communication and Coordination	[Core-Tier1] • Shared Memory • Consistency, and its role in programming language guarantees for data-race-free programs [Core-Tier2] • Message passing - o Point-to-point versus multicast (or event-based) messages - o Blocking versus non-blocking styles for sending and receiving messages - o Message buffering (cross-reference PF/Fundamental Data Structures/Queues) • Atomicity - o Specifying and testing atomicity and safety requirements - o Granularity of atomic accesses and updates, and the use of constructs such as critical sections or transactions to describe them - o Mutual Exclusion using locks, semaphores, monitors, or related constructs ♣ Potential for liveness failures and deadlock (causes, conditions, prevention)



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		- o Composition ♣ Composing larger granularity atomic actions using synchronization ♣ Transactions, including optimistic and conservative approaches [Elective] • Consensus - o (Cyclic) barriers, counters, or related constructs • Conditional actions - o Conditional waiting (e.g., using condition variables)
29.	PD/Parallel Algorithms, Analysis, and Programming	[Core-Tier2] • Critical paths, work and span, and the relation to Amdahl's law (cross-reference SF/Performance) • Speed-up and scalability • Naturally (embarrassingly) parallel algorithms • Parallel algorithmic patterns (divide-and-conquer, map and reduce, master-workers, others) - o Specific algorithms (e.g., parallel MergeSort) [Elective] • Parallel graph algorithms (e.g., parallel shortest path, parallel spanning tree) (cross-reference AL/Algorithmic Strategies/Divide-and-conquer) • Parallel matrix computations • Producer-consumer and pipelined algorithms • Examples of non-scalable parallel algorithms
30.	PD/Parallel Performance	• Load balancing • Performance measurement • Scheduling and contention (cross-reference OS/Scheduling and Dispatch) • Evaluating communication overhead • Data management - o Non-uniform communication costs due to proximity (cross-reference SF/Proximity) - o Cache effects (e.g., false sharing) - o Maintaining spatial locality • Power usage and management
31.	IAS/Digital Forensics	• Basic Principles and methodologies for digital forensics • Design systems with forensic needs in mind • Rules of Evidence – general concepts and differences between jurisdictions and Chain of Custody • Search and Seizure of evidence: legal and procedural requirements • Digital Evidence methods and standards • Techniques and standards for Preservation of Data • Legal and Reporting Issues including working as an expert witness • OS/File System Forensics • Application Forensics • Web Forensics



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• Network Forensics • Mobile Device Forensics • Computer/network/system attacks • Attack detection and investigation • Anti-forensics
32.	IAS/Secure Software Engineering	• Building security into the software development lifecycle (cross-reference SE/Software Processes) • Secure design principles and patterns • Secure software specifications and requirements • Secure software development practices (cross-reference SE/Software Construction) • Secure testing - the process of testing that security requirements are met (including static and dynamic analysis). • Software quality assurance and benchmarking measurements
33.	NC/Local Area Networks	• Multiple Access Problem • Common approaches to multiple access (exponential-backoff, time division multiplexing, etc) • Local Area Networks • Ethernet • Switching
34.	SE/Software Design	[Core-Tier1] • System design principles: levels of abstraction (architectural design and detailed design), separation of concerns, information hiding, coupling and cohesion, re-use of standard structures • Design Paradigms such as structured design (top-down functional decomposition), object-oriented analysis and design, event driven design, component-level design, data-structured centered, aspect oriented, function oriented, service oriented • Structural and behavioral models of software designs • Design patterns [Core-Tier2] • Relationships between requirements and designs: transformation of models, design of contracts, invariants • Software architecture concepts and standard architectures (e.g. client-server, n-layer, transform centered, pipes-and-filters) • Refactoring designs using design patterns • The use of components in design: component selection, design, adaptation and assembly of components, components and patterns, components and objects (for example, building a GUI using a standard widget set) [Elective] • Internal design qualities, and models for them: efficiency and performance, redundancy and fault tolerance, traceability of requirements • External design qualities, and models for them:



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		functionality, reliability, performance and efficiency, usability, maintainability, portability • Measurement and analysis of design quality • Tradeoffs between different aspects of quality • Application frameworks • Middleware: the object-oriented paradigm within middleware, object request brokers and marshalling, transaction processing monitors, workflow systems • Principles of secure design and coding (cross-reference IAS/Principles of Secure Design) - o Principle of least privilege - o Principle of fail-safe defaults - o Principle of psychological acceptability
35.	PD/Parallelism Fundamentals	• Multiple simultaneous computations • Goals of parallelism (e.g., throughput) versus concurrency (e.g., controlling access to shared resources) • Parallelism, communication, and coordination - o Programming constructs for coordinating multiple simultaneous computations - o Need for synchronization • Programming errors not found in sequential programming - o Data races (simultaneous read/write or write/write of shared state) - o Higher-level races (interleavings violating program intention, undesired non-determinism) - o Lack of liveness/progress (deadlock, starvation)
36.	PD/Parallel Decomposition	[Core-Tier1] • Need for communication and coordination/synchronization • Independence and partitioning [Core-Tier2] • Basic knowledge of parallel decomposition concepts (cross-reference SF/System Support for Parallelism) • Task-based decomposition - o Implementation strategies such as threads • Data-parallel decomposition - o Strategies such as SIMD and MapReduce • Actors and reactive processes (e.g., request handlers)
37.	PD/Parallel Architecture	The topics listed here are related to knowledge units in the Architecture and Organization (AR) knowledge area (AR/Assembly Level Machine Organization and AR/Multiprocessing and Alternative Architectures). Here, we focus on parallel architecture from the standpoint of applications, whereas the Architecture and Organization knowledge area presents the topic from the hardware perspective.
38.	NC/Mobility	• Principles of cellular networks



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• 802.11 networks • Issues in supporting mobile nodes (home agents)
39.	SE/Software Evolution	• Software development in the context of large, pre-existing code bases - o Software change - o Concerns and concern location - o Refactoring • Software evolution • Characteristics of maintainable software • Reengineering systems • Software reuse - o Code segments - o Libraries and frameworks - o Components - o Product lines
40.	SE/Software Verification and Validation	[Core-Tier2] • Verification and validation concepts • Inspections, reviews, audits • Testing types, including human computer interface, usability, reliability, security, conformance to specification (cross-reference IAS/Secure Software Engineering) • Testing fundamentals (cross-reference SDF/Development Methods) - o Unit, integration, validation, and system testing - o Test plan creation and test case generation - o Black-box and white-box testing techniques - o Regression testing and test automation • Defect tracking • Limitations of testing in particular domains, such as parallel or safety-critical systems [Elective] • Static approaches and dynamic approaches to verification • Test-driven development • Validation planning; documentation for validation • Object-oriented testing; systems testing • Verification and validation of non-code artifacts (documentation, help files, training materials) • Fault logging, fault tracking and technical support for such activities • Fault estimation and testing termination including defect seeding
41.	SP/Economies of Computing	• Monopolies and their economic implications • Effect of skilled labor supply and demand on the quality of computing products • Pricing strategies in the computing domain • The phenomenon of outsourcing and off-shoring software development; impacts on employment and on economics



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• Consequences of globalization for the computer science profession - 202 - • Differences in access to computing resources and the possible effects thereof • Cost/benefit analysis of jobs with considerations to manufacturing, hardware, software, and engineering implications • Cost estimates versus actual costs in relation to total costs • Entrepreneurship: prospects and pitfalls • Network effect or demand-side economies of scale • Use of engineering economics in dealing with finances
42.	SE/Software Processes	[Core-Tier1] • Systems level considerations, i.e., the interaction of software with its intended environment (crossreference IAS/Secure Software Engineering) • Introduction to software process models (e.g., waterfall, incremental, agile) - o Activities within software lifecycles • Programming in the large vs. individual programming [Core-Tier2] • Evaluation of software process models [Elective] • Software quality concepts • Process improvement • Software process capability maturity models • Software process measurements
43.	SE/Software Project Management	[Core-Tier2] • Team participation - o Team processes including responsibilities for tasks, meeting structure, and work schedule - o Roles and responsibilities in a software team - o Team conflict resolution - o Risks associated with virtual teams (communication, perception, structure) • Effort Estimation (at the personal level) • Risk (cross reference IAS/Secure Software Engineering) - o The role of risk in the lifecycle - o Risk categories including security, safety, market, financial, technology, people, quality, structure and process [Elective] • Team management - o Team organization and decision-making - o Role identification and assignment - o Individual and team performance assessment • Project management - o Scheduling and tracking - o Project management tools



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		- o Cost/benefit analysis • Software measurement and estimation techniques • Software quality assurance and the role of measurements • Risk - o Risk identification and management - o Risk analysis and evaluation - o Risk tolerance (e.g., risk-adverse, risk-neutral, risk-seeking) - o Risk planning • System-wide approach to risk including hazards associated with tools
44.	SE/Requirements Engineering	The purpose of requirements engineering is to develop a common understanding of the needs, priorities, and constraints relevant to a software system. Many software failures arise from an incomplete understanding of requirements for the software to be developed or inadequate management of those requirements. Specifications of requirements range in formality from completely informal (e.g., spoken) to rigorously mathematical (e.g., written in a formal specification language such as Z or first-order logic). In practice, successful software engineering efforts use requirements specifications to reduce ambiguity and improve the consistency and completeness of the development team's understanding of the vision of the intended software. Plan-driven approaches tend to produce formal documents with numbered requirements. Agile approaches tend to favor less formal specifications that include user stories, use cases, and test cases.
45.	SE/Software Construction	[Core-Tier2] • Coding practices: techniques, idioms/patterns, mechanisms for building quality programs (cross-reference IAS/Defensive Programming; SDF/Development Methods) - o Defensive coding practices - o Secure coding practices - o Using exception handling mechanisms to make programs more robust, fault-tolerant • Coding standards • Integration strategies • Development context: "green field" vs. existing code base - o Change impact analysis - o Change actualization [Elective] • Potential security problems in programs - o Buffer and other types of overflows - o Race conditions - o Improper initialization, including choice of privileges - o Checking input



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		- o Assuming success and correctness - o Validating assumptions
46.	HCI/Designing Interaction	• Principles of graphical user interfaces (GUIs) • Elements of visual design (layout, color, fonts, labeling) • Task analysis, including qualitative aspects of generating task analytic models • Low-fidelity (paper) prototyping • Quantitative evaluation techniques, e.g., keystroke-level evaluation • Help and documentation • Handling human/system failure • User interface standards
47.	HCI/Mixed, Augmented and Virtual Reality	• Output - o Sound - o Stereoscopic display - o Force feedback simulation, haptic devices • User input - o Viewer and object tracking - o Pose and gesture recognition - o Accelerometers - o Fiducial markers - o User interface issues • Physical modelling and rendering - o Physical simulation: collision detection & response, animation - o Visibility computation - o Time-critical rendering, multiple levels of details (LOD) • System architectures - o Game engines - o Mobile augmented reality - o Flight simulators - o CAVEs - o Medical imaging • Networking - o p2p, client-server, dead reckoning, encryption, synchronization - o Distributed collaboration
48.	GV/Fundamental Concepts	For nearly every computer scientist and software developer, an understanding of how humans interact with machines is essential. While these topics may be covered in a standard undergraduate graphics course, they may also be covered in introductory computer science and programming courses. Part of our motivation for including immediate and retained modes is that these modes are analogous to polling vs. event driven programming. This is a fundamental the question in computer science: Is there a button object, or is there just the display of a button on the screen? Note that most of the outcomes in this section are at the knowledge level, and many of these topics are



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		revisited in greater depth in later sections.
49.	GV/Basic Rendering	This section describes basic rendering and fundamental graphics techniques that nearly every undergraduate course in graphics will cover and that are essential for further study in graphics. Sampling and anti-aliasing are related to the effect of digitization and appear in other areas of computing, for example, in audio sampling.
50.	GV/Geometric Modeling	• Basic geometric operations such as intersection calculation and proximity tests • Volumes, voxels, and point-based representations • Parametric polynomial curves and surfaces • Implicit representation of curves and surfaces • Approximation techniques such as polynomial curves, Bezier curves, spline curves and surfaces, and nonuniform rational basis (NURB) spines, and level set method • Surface representation techniques including tessellation, mesh representation, mesh fairing, and mesh generation techniques such as Delaunay triangulation, marching cubes • Spatial subdivision techniques • Procedural models such as fractals, generative modeling, and L-systems • Graftals, cross referenced with programming languages (grammars to generated pictures) • Elastically deformable and freeform deformable models • Subdivision surfaces • Multiresolution modeling • Reconstruction • Constructive Solid Geometry (CSG) representation
51.	GV/Advanced Rendering	• Solutions and approximations to the rendering equation, for example: - o Distribution ray tracing and path tracing - o Photon mapping - o Bidirectional path tracing - o Reyes (micropolygon) rendering - o Metropolis light transport • Time (motion blur), lens position (focus), and continuous frequency (color) and their impact on rendering • Shadow mapping • Occlusion culling • Bidirectional Scattering Distribution function (BSDF) theory and microfacets • Subsurface scattering • Area light sources • Hierarchical depth buffering • The Light Field, image-based rendering • Non-photorealistic rendering • GPU architecture • Human visual systems including adaptation to light,



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		sensitivity to noise, and flicker fusion
52.	GV/Computer Animation	• Forward and inverse kinematics • Collision detection and response • Procedural animation using noise, rules (boids/crowds), and particle systems • Skinning algorithms • Physics based motions including rigid body dynamics, physical particle systems, mass-spring networks for cloth and flesh and hair • Key-frame animation • Splines • Data structures for rotations, such as quaternions • Camera animation • Motion capture
53.	GV/Visualization	Visualization has strong ties to the Human-Computer Interaction (HCI) knowledge area as well as Computational Science (CN). Readers should refer to the HCI and CN KAs for additional topics related to user population and interface evaluations.
54.	CN/Introduction to Modeling and Simulation	Abstraction is a fundamental concept in computer science. A principal approach to computing is to abstract the real world, create a model that can be simulated on a machine. The roots of computer science can be traced to this approach, modeling things such as trajectories of artillery shells and the modeling cryptographic protocols, both of which pushed the development of early computing systems in the early and mid-1940's. Modeling and simulation of real world systems represent essential knowledge for computer scientists and provide a foundation for computational sciences. Any introduction to modelling and simulation would either include or presume an introduction to computing. In addition, a general set of modeling and simulation techniques, data visualization methods, and software testing and evaluation mechanisms are also important.
55.	CN/Modeling and Simulation	• Purpose of modeling and simulation including optimization; supporting decision making, forecasting, safety considerations; for training and education • Tradeoffs including performance, accuracy, validity, and complexity • The simulation process; identification of key characteristics or behaviors, simplifying assumptions; validation of outcomes • Model building: use of mathematical formulas or equations, graphs, constraints; methodologies and techniques; use of time stepping for dynamic systems • Formal models and modeling techniques: mathematical descriptions involving simplifying assumptions and avoiding detail. Examples of techniques include:



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		- o Monte Carlo methods - o Stochastic processes - o Queuing theory - o Petri nets and colored Petri nets - o Graph structures such as directed graphs, trees, networks - o Games, game theory, the modeling of things using game theory - o Linear programming and its extensions - o Dynamic programming - o Differential equations: ODE, PDE - o Non-linear techniques - o State spaces and transitions • Assessing and evaluating models and simulations in a variety of contexts; verification and validation of models and simulations • Important application areas including health care and diagnostics, economics and finance, city and urban planning, science, and engineering • Software in support of simulation and modeling; packages, languages
56.	CN/Processing	The processing topic area includes numerous topics from other knowledge areas. Specifically, coverage of processing should include a discussion of hardware architectures, including parallel systems, memory hierarchies, and interconnections among processors. These are covered in AR/Interfacing and Communication, AR/Multiprocessing and Alternative Architectures, AR/Performance Enhancements.
57.	CN/Numerical Analysis	• Error, stability, convergence, including truncation and round-off • Function approximation including Taylor's series, interpolation, extrapolation, and regression • Numerical differentiation and integration (Simpson's Rule, explicit and implicit methods) • Differential equations (Euler's Method, finite differences)
58.	IM/Database Systems	[Core-Tier2] • Approaches to and evolution of database systems • Components of database systems - 114 - • Design of core DBMS functions (e.g., query mechanisms, transaction management, buffer management, access methods) • Database architecture and data independence • Use of a declarative query language • Systems supporting structured and/or stream content [Elective] • Approaches for managing large volumes of data (e.g., noSQL database systems, use of MapReduce)



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
59.	IM/Relational Databases	• Mapping conceptual schema to a relational schema • Entity and referential integrity • Relational algebra and relational calculus • Relational Database design • Functional dependency • Decomposition of a schema; lossless-join and dependency-preservation properties of a decomposition • Candidate keys, superkeys, and closure of a set of attributes • Normal forms (BCNF) • Multi-valued dependency (4NF) • Join dependency (PJNF, 5NF) • Representation theory
60.	IM/Transaction Processing	• Transactions • Failure and recovery • Concurrency control • Interaction of transaction management with storage, especially buffering
61.	IM/Information Management Concepts	[Core-Tier1] • Information systems as socio-technical systems • Basic information storage and retrieval (IS&R) concepts • Information capture and representation • Supporting human needs: searching, retrieving, linking, browsing, navigating [Core-Tier2] • Information management applications • Declarative and navigational queries, use of links • Analysis and indexing • Quality issues: reliability, scalability, efficiency, and effectiveness
62.	PBD/Introduction	• Overview of platforms (e.g., Web, Mobile, Game, Industrial) • Programming via platform-specific APIs • Overview of Platform Languages (e.g., Objective C, HTML5) • Programming under platform constraints
63.	PBD/Mobile Platforms	• Mobile programming languages • Challenges with mobility and wireless communication • Location-aware applications • Performance / power tradeoffs • Mobile platform constraints • Emerging technologies
64.	AL/Basic Analysis	[Core-Tier1] • Differences among best, expected, and worst case behaviors of an algorithm • Asymptotic analysis of upper and expected complexity bounds • Big O notation: formal definition



No/Kode	Course Material <i>Bahan Kajian</i>	Description of Course Material <i>Deskripsi Bahan Kajian</i>
		• Complexity classes, such as constant, logarithmic, linear, quadratic, and exponential • Empirical measurements of performance • Time and space trade-offs in algorithms [Core-Tier2] • Big O notation: use • Little o, big omega and big theta notation • Recurrence relations • Analysis of iterative and recursive algorithms • Some version of a Master Theorem
65.	AL/Fundamental Data Structures and Algorithms	This knowledge unit builds directly on the foundation provided by Software Development Fundamentals (SDF), particularly the material in SDF/Fundamental Data Structures and SDF/Algorithms and Design.
66.	AL/Advanced Computational Complexity	• Review of the classes P and NP; introduce P-space and EXP • Polynomial hierarchy • NP-completeness (Cook's theorem) • Classic NP-complete problems • Reduction Techniques
67.	AL/Advanced Automata Theory and Computability	• Sets and languages - o Regular languages - o Review of deterministic finite automata (DFAs) - o Nondeterministic finite automata (NFAs) - o Equivalence of DFAs and NFAs - o Review of regular expressions; their equivalence to finite automata - o Closure properties - o Proving languages non-regular, via the pumping lemma or alternative means • Context-free languages - o Push-down automata (PDAs) - o Relationship of PDAs and context-free grammars - o Properties of context-free languages • Turing machines, or an equivalent formal model of universal computation • Nondeterministic Turing machines • Chomsky hierarchy • The Church-Turing thesis • Computability • Rice's Theorem • Examples of uncomputable functions • Implications of uncomputability



6. Formation of Course and Determination of The Weight of Credits (Pembentukan Mata Kuliah dan Penentuan Bobot SKS)

Table 10. Mapping Subject Course and PLO

Code Kode	Subject Mata Kuliah	PLO CPL								
		PLO- IF-1	PLO- IF-2	PLO- IF-3	PLO- IF-4	PLO- IF-5	PLO- IF-6	PLO- IF-7	PLO- IF-8	PLO- IF-9
1 st Semester										
IF185101	Computational Intelligence <i>Kecerdasan Komputasional</i>									
IF185102	Net-Centric Computing <i>Komputasi Berbasis Jaringan</i>									
IF185998	Matriculation-Object Oriented Programming <i>Matrikulasi-Pemrograman Berorientasi Obyek</i>									
IF185997	Matriculation-Data Structure <i>Matrikulasi-Struktur Data</i>									
IF185103	Software Engineering <i>Rekayasa Perangkat Lunak</i>									
IF185961	Advance topics in System Audit <i>Topik Dalam Audit Sistem</i>									
IF185951	Advance topics in Data Mining <i>Topik Dalam Data Mining</i>									
IF185911	Advance topics in Network Design and Audit <i>Topik Dalam Desain dan Audit Jaringan</i>									
IF185971	Advance topics in Software Evolution <i>Topik Dalam Evolusi Perangkat Lunak</i>									



Code Kode	Subject Mata Kuliah	PLO CPL								
		PLO- IF-1	PLO- IF-2	PLO- IF-3	PLO- IF-4	PLO- IF-5	PLO- IF-6	PLO- IF-7	PLO- IF-8	PLO- IF-9
IF185931	Advance topics in Human and Computer Interaction <i>Topik Dalam Interaksi Manusia dan Komputer</i>									
IF185941	Advance topics in Multimedia Networking <i>Topik Dalam Jaringan Multimedia</i>									
IF185921	Advance topics in Modelling and Simulation <i>Topik Dalam Pemodelan dan Simulasi</i>									
IF185952	Advance topics in Information Retrieval <i>Topik Dalam Sistem Temu Kembali Informasi</i>									
IF185942	Advance topics in Distributed Systems <i>Topik Dalam Sistem Terdistribusi</i>									
2 nd Semester										
IF185201	Research Methodology <i>Metodologi Penelitian</i>									
IF185922	Advance topics in Time Series Data Analysis <i>Topik Dalam Analisis Data Deret Waktu</i>									
IF185963	Advance topics in Geospatial Data Analysis <i>Topik Dalam Analisis Data</i>									



Code Kode	Subject Mata Kuliah	PLO CPL								
		PLO- IF-1	PLO- IF-2	PLO- IF-3	PLO- IF-4	PLO- IF-5	PLO- IF-6	PLO- IF-7	PLO- IF-8	PLO- IF-9
	<i>Geospasial</i>									
IF185943	Advance topics in Digital Forensic <i>Topik Dalam Forensik Digital</i>									
IF185933	Advance topics in Computer Graphics <i>Topik Dalam Grafika Komputer</i>									
IF185947	Advance topics in Wireless Network <i>Topik Dalam Jaringan Nirkabel</i>									
IF185912	Advance topics in Cyber Security <i>Topik Dalam Keamanan Siber</i>									
IF185946	Advance topics in Cloud Computing <i>Topik Dalam Komputasi Awan</i>									
IF185945	Advance topics in Mobile Computing <i>Topik Dalam Komputasi Bergerak</i>									
IF185972	Advance topics in Software Project Management <i>Topik Dalam Manajemen Proyek Perangkat Lunak</i>									
IF185944	Advance topics in Network Security <i>Topik Dalam Pengaman Jaringan</i>									
IF185932	Advance topics in Game Development, Virtual Reality, and Augmented Reality <i>Topik Dalam Pengembangan Game, Realitas Virtual, dan Realitas</i>									



Code Kode	Subject Mata Kuliah	PLO CPL								
		PLO- IF-1	PLO- IF-2	PLO- IF-3	PLO- IF-4	PLO- IF-5	PLO- IF-6	PLO- IF-7	PLO- IF-8	PLO- IF-9
	<i>Augmentasi</i>									
IF185953	Advance topics in Image Processing <i>Topik Dalam Pengolahan Citra Digital</i>									
IF185974	Advance topics in Software Quality Assurance <i>Topik Dalam Penjaminan Kualitas Perangkat Lunak</i>									
IF185973	Advance topics in Requirement Engineering <i>Topik Dalam Rekayasa Kebutuhan</i>									
IF185962	Advance topics in Knowledge Based Engineering <i>Topik Dalam Rekayasa Sistem Berbasis Pengetahuan</i>									
IF185954	Advance topics in Computer Vision <i>Topik Dalam Visi Komputer</i>									
3 rd Semester										
IF185301	Thesis – Proposal <i>Tesis - Proposal</i>									
IF185302	Thesis - Scientific Publication <i>Tesis - Publikasi Ilmiah</i>									
4 th Semester										
IF185401	Thesis - Final Defense <i>Tesis - Sidang Akhir</i>									



7. Organization of Study Program Courses (*Organisasi Mata Kuliah Program Studi*)

Table 11. Organization Matrix of Study Program Courses

Semester <i>Semester</i>	Credits <i>SKS</i>	Number of Courses <i>Jumlah Mata Kuliah</i>	GROUP OF MASTER PROGRAM COURSES <i>KELOMPOK MATA KULIAH PROGRAM MAGISTER</i>		
			Compulsory Course <i>Mata Kuliah Wajib</i>	Elective Course <i>Mata Kuliah Pilihan</i>	Thesis <i>Tesis</i>
I	3	14	5	9	
II	3	17	1	16	
III	3	2			2
IV	3	1			1
Total	105				

Table 12 MIP Courses List

1 st Semester				2 nd Semester		
Code	Courses	Credits		Code	Courses	Credits
IF185101	Computational Intelligence	3		IF185201	Research Methodology	3
IF185102	Net-Centric Computing	3		IF1859XY	Elective Course 2	3
IF185103	Software Engineering	3		IF1859XY	Elective Course 3	3
IF1859XY	Elective Course 1	3		IF1859XY	Elective Course 4	3
Credits' Total		12		Credits' Total		12
3 rd Semester				4 th Semester		
Code	Courses	Credits		Code	Courses	Credits
IF185301	Thesis – Proposal	3		IF185401	Thesis – Final Defense	6
IF185302	Thesis – Scientific Publication	3				
Credits' Total		6		Credits' Total		6
MIP Credits' Total: 36 credits						

Table 13 MIP Elective Courses List

Code	Elective Courses	Credits	Semester
Software Engineering			
IF185971	Advance topics in Software Evolution	3	1 st
IF185972	Advance topics in Software Project Management	3	2 nd
IF185974	Advance topics in Software Quality Assurance	3	2 nd
IF185973	Advance topics in Requirement Engineering	3	2 nd
IF185962	Advance topics in Knowledge-Based Engineering	3	2 nd
Net-Centric Computing			
IF185941	Advance topics in Multimedia Networking	3	1 st
IF185942	Advance topics in Distributed Systems	3	1 st
IF185943	Advance topics in Digital Forensic	3	2 nd
IF185944	Advance topics in Network Security	3	2 nd
IF185945	Advance topics in Mobile Computing	3	2 nd



Code	Elective Courses	Credits	Semester
IF185946	Advance topics in Cloud Computing	3	2 nd
IF185947	Advance topics in Wireless Network	3	2 nd
Intelligence Computing and Vision			
IF185951	Advance topics in Data Mining	3	1 st
IF185952	Advance topics in Information Retrieval	3	1 st
IF185953	Advance topics in Image Processing	3	2 nd
IF185954	Advance topics in Computer Vision	3	2 nd
Computer Network Architecture			
IF185911	Advance topics in Network Design and Audit	3	1 st
IF185912	Advance topics in Cyber Security	3	2 nd
Applied Computing and Modelling			
IF185921	Advance topics in Modelling and Simulation	3	1 st
IF185922	Advance topics in Time Series Data Analysis	3	2 nd
Graphics, Interactions, and Games			
IF185931	Advance topics in Human and Computer Interaction	3	1 st
IF185932	Advance topics in Game Development, Virtual Reality, and Augmented Reality	3	2 nd
IF185933	Advance topics in Computer Graphics	3	2 nd
Intelligence Information Management			
IF185961	Advance topics in System Audit	3	1 st
IF185963	Advance topics in Geospatial Data Analysis	3	2 nd

Students can take 4 elective courses, 2 elective courses in 1st semester and 2 elective courses in 2nd semester. Students are required to take 2 elective courses (6 credits) in one specialization to better support on students' study plan (thesis research). As for the other 2 elective courses can take in other different specializations.

Mahasiswa dapat mengambil empat mata kuliah pilihan, mata kuliah di semester 1 dan dua mata kuliah di semester 2. Mahasiswa diwajibkan mengambil dua mata kuliah (6 sks) dalam satu spesialisasi atau rumpun mata kuliah untuk mendukung rencana belajar atau topik penelitian tesis. Sedangkan, dua mata kuliah lain dapat diambil di spesialisasi yang berbeda.



8. List of Course Distribution for Each Semester (*Daftar Sebaran Mata Kuliah Tiap Semester*)

Table 14. List of 1st Semester Course

1 st Semester SEMESTER I						
No	Code Kode	Courses Mata Kuliah	Credit Weight Bobot sks			
			Theory Teori	Practicum Praktikum	Practice Praktek	Total Jumlah
1	IF185101	Computational Intelligence <i>Kecerdasan Komputasional</i>				
2	IF185102	Net-Centric Computing <i>Komputasi Berbasis Jaringan</i>				
3	IF185998	Matriculation-Object Oriented Programming <i>Matrikulasi-Pemrograman Berorientasi Obyek</i>				
4	IF185997	Matriculation-Data Structure <i>Matrikulasi-Struktur Data</i>				
5	IF185103	Software Engineering <i>Rekayasa Perangkat Lunak</i>				
6	IF185961	Advance topics in System Audit <i>Topik Dalam Audit Sistem</i>				
7	IF185951	Advance topics in Data Mining <i>Topik Dalam Data Mining</i>				
8	IF185911	Advance topics in Network Design and Audit <i>Topik Dalam Desain dan Audit Jaringan</i>				
9	IF185971	Advance topics in Software Evolution <i>Topik Dalam Evolusi Perangkat Lunak</i>				
10	IF185931	Advance topics in Human and Computer Interaction <i>Topik Dalam Interaksi Manusia dan Komputer</i>				
11	IF185941	Advance topics in Multimedia Networking <i>Topik Dalam Jaringan Multimedia</i>				
12	IF185921	Advance topics in Modelling and Simulation <i>Topik Dalam Pemodelan dan Simulasi</i>				
13	IF185952	Advance topics in Information Retrieval <i>Topik Dalam Sistem Temu Kembali Informasi</i>				



1st Semester SEMESTER I						
No	Code Kode	Courses Mata Kuliah	Credit Weight Bobot sks			
			Theory Teori	Practicum Praktikum	Practice Praktek	Total Jumlah
14	IF185942	Advance topics in Distributed Systems <i>Topik Dalam Sistem Terdistribusi</i>				
Credit Weight Total of 1st Semester Course <i>Jumlah Beban Studi Semester I</i>						

Table 15. List of 2nd Semester Course

2nd Semester SEMESTER II						
No	Code Kode	Courses Mata Kuliah	Credit Weight Bobot sks			
			Theory Teori	Practicum Praktikum	Practice Praktek	Total Jumlah
1	IF185201	Research Methodology <i>Metodologi Penelitian</i>				
2	IF185922	Advance topics in Time Series Data Analysis <i>Topik Dalam Analisis Data Deret Waktu</i>				
3	IF185963	Advance topics in Geospatial Data Analysis <i>Topik Dalam Analisis Data Geospasial</i>				
4	IF185943	Advance topics in Digital Forensic <i>Topik Dalam Forensik Digital</i>				
5	IF185933	Advance topics in Computer Graphics <i>Topik Dalam Grafika Komputer</i>				
6	IF185947	Advance topics in Wireless Network <i>Topik Dalam Jaringan Nirkabel</i>				
7	IF185912	Advance topics in Cyber Security <i>Topik Dalam Keamanan Siber</i>				
8	IF185946	Advance topics in Cloud Computing <i>Topik Dalam Komputasi Awan</i>				
9	IF185945	Advance topics in Mobile Computing <i>Topik Dalam Komputasi</i>				



2nd Semester SEMESTER II						
No	Code Kode	Courses Mata Kuliah	Credit Weight Bobot sks			
			Theory Teori	Practicum Praktikum	Practice Praktek	Total Jumlah
		<i>Bergerak</i>				
10	IF185972	Advance topics in Software Project Management <i>Topik Dalam Manajemen Proyek Perangkat Lunak</i>				
11	IF185944	Advance topics in Network Security <i>Topik Dalam Pengaman Jaringan</i>				
12	IF185932	Advance topics in Game Development, Virtual Reality, and Augmented Reality <i>Topik Dalam Pengembangan Game, Realitas Virtual, dan Realitas Augmentasi</i>				
13	IF185953	Advance topics in Image Processing <i>Topik Dalam Pengolahan Citra Digital</i>				
14	IF185974	Advance topics in Software Quality Assurance <i>Topik Dalam Penjaminan Kualitas Perangkat Lunak</i>				
15	IF185973	Advance topics in Requirement Engineering <i>Topik Dalam Rekayasa Kebutuhan</i>				
16	IF185962	Advance topics in Knowledge Based Engineering <i>Topik Dalam Rekayasa Sistem Berbasis Pengetahuan</i>				
17	IF185954	Advance topics in Computer Vision <i>Topik Dalam Visi Komputer</i>				
Credit Weight Total of 2nd Semester Course <i>Jumlah Beban Studi Semester II</i>						

Table 16. List of 3rd Semester Course

3 rd Semester SEMESTER III						
No	Code Kode	Courses Mata Kuliah	Credit Weight Bobot sks			
			Theory Teori	Practicum Praktikum	Practice Praktek	Total Jumlah
1	IF185301	Thesis – Proposal <i>Tesis - Proposal</i>				
2	IF185302	Thesis - Scientific Publication <i>Tesis - Publikasi Ilmiah</i>				
Credit Weight Total of 3 rd Semester Course <i>Jumlah Beban Studi Semester III</i>						

Table 17. List of 4th Semester Course

4 th Semester SEMESTER IV						
No	Code Kode	Courses Mata Kuliah	Credit Weight Bobot sks			
			Theory Teori	Practicum Praktikum	Practice Praktek	Total Jumlah
1	IF185401	Thesis - Final Defense <i>Tesis - Sidang Akhir</i>				
Credit Weight Total of 4 th Semester Course <i>Jumlah Beban Studi Semester IV</i>						

9. Learning Plan (*Rencana Pembelajaran Semester*)

COURSE	Course Name: Computational Intelligence
	Course Code : IF185101
	Credit : 3
	Semester : 1
DESCRIPTION OF COURSE	
Students learn about several types of input data, Fourier and Wavelet transforms, a comprehensive understanding of the classification method with supervised and unsupervised learning, and methods of optimization with evolutionary algorithms, as well as the reduction and transformation of data. Students implement these methods to a case study in the form of project tasks, starting from data input, processing and data extraction, data reduction, optimization and classification by applying the supervised and unsupervised learning, and write papers of the modeling results. Supervised learning includes the multilayer perceptron, RBF, ANFIS, SVM, and the soft SVM. Unsupervised learning covers a variety of clustering methods. Optimization methods cover evolutionary algorithms such as Genetic Algorithm (GA), Ant Colony (ACO), Particle Swarm Optimization (PSO), Artificial Bee Colony. Reduction and transformation of data includes Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA), and Independent Component Analysis (ICA).	
GRADUATE LEARNING OUTCOMES	
1. Mastering theory and application theory of representation and reasoning techniques,	



searching technique, intelligent agent, data mining, machine learning, and development of intelligent application in various fields, and also mastering concept and principles of computation science such as manage information, multimedia data processing, and numerical analysis.

2. Capable of developing applications using principles of intelligent systems and computing science to produce intelligent applications in various fields and disciplinary of science.

COURSE LEARNING OUTCOME

1. Students are able to explain the kinds of input data, description of the process, data extraction, feature vectors, and classifier.
2. Students are able to explain the function of the Fourier transform, Wavelet, and its application to feature extraction.
3. Students are able to explain the various methods of clustering and its applications.
4. Students are able to explain the various methods of artificial neural networks, multilayer perceptron, RBF, ANFIS, SVM, and the soft SVM.
5. Students are able to explain the clustering method and artificial neural networks, ANFIS, and SVM in an application and analyze the related research.
6. Students are able to explain the methods of optimization with evolutionary algorithms: Genetic Algorithm (GA), Ant Colony (ACO), Particle Swarm Optimization (PSO), and Artificial Bee Colony (ABC).
7. Students are able to explain the Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA), PCA and LDA difference, Independent Component Analysis (ICA), and its application.
8. Students are able to apply classifier combination with optimization methods or with PCA and LDA in an application and analyze the related research.
9. Students are able to apply the feature vector extraction and classification, and also analyze the results of related research.
10. Students are able to write reports and papers from the implementation of classification models.

MAIN SUBJECT

1. DATA INPUT: available dataset, static data, dynamic data, machine perception, model illustration consisting of preprocessing, feature extraction, classification.
2. Bayesian classification: a review of the concept of Bayes decision theory and discriminant functions, discriminant functions for normal density and discuss the applications that use Bayesian classification.
3. DATA TRANSFORMATION: Discrete Fourier Transform, Fast Fourier Transform (FFT), Discrete Time Wavelet Transform.
4. CLUSTERING: Hard clustering, vector quantization, fuzzy clustering, kernel clustering methods, hierachical clustering, application examples.
5. FUZZY LOGIC, Approximate Reasoning: a review of the various membership functions, reasoning approach with multiple rules, Mamdani implication function.
6. Linear and nonlinear classifiers: multilayer perceptron, Radial Basis Function, ANFIS, SVM, decision tree, combination classifiers.
7. IMPLEMENTATION OF CLUSTERING METHOD AND NEURAL NETWORKS, AND ANALYSIS OF RESEARCH RELATED PAPERS.
8. EVOLUTIONARY ALGORITHM: a review of the concept of Genetic Algorithm (GA), Ant Colony Optimization (ACO), Particle Swarm Optimization (PSO), Artificial Bee Colony (ABC).
9. DIMENSIONAL REDUCTION AND DATA TRANSFORMATION: review the concept of Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA), Independent Component Analysis (ICA), and application examples.
10. IMPLEMENTATION OF CLASSIFIERS COMBINED WITH OPTIMIZATION METHODS OR WITH PCA AND LDA, AND 9 ANALYSIS OF THE RELATED RESEARCH.
11. IMPLEMENTATION OF FEATURE VECTOR EXTRACTION AND CLASSIFICATION IN A GROUP PROJECT, AND ANALYSIS THE RELATED RESEARCH.



12. WRITING REPORTS AND PAPERS OF THE IMPLEMENTATION OF CLASSIFICATION MODELS.

PREREQUISITES

REFERENCE

1. Sergios Theodoridis, Konstantinos Koutroumbas, Pattern Recognition, 4th ed., Elsevier Inc., 2009.
2. R.O. Duda, P.E.Hart, D.G.Stork, Pattern Classification, John Wiley & Sons, Inc., 2001
3. Amit Konar, Computational Intelligence, Springer, 2005.
4. C. H. Bishop, Pattern Recognition and Machine Learning, Springer Science, 2006.
5. Journal: a. Expert Systems with Applications, www.sciencedirect.com
b. IEEE Intelligent Systems Magazine
c. Journal of Biomedical Informatics, Elsevier
6. Simon Haykin, Neural Networks: A Comprehensive Foundation (2nd Edition), Prentice Hall, 1998.
7. Christian Blum, Daniel Merkle, Swarm Intelligence : Introduction and Applications, Springer-Verlag 2008.

COURSE	Course Name : Net-Centric Computing
	Course Code : IF185102
	Credit : 3
	Semester : 1
DESCRIPTION OF COURSE	
This course is an introduction of a variety of topics related to Network-Based Computing. In this course will discuss various issues and technology trends to provide further insights in the Network-Based Computing.	
GRADUATE LEARNING OUTCOMES	
1. Mastering theory and application theory of net-centric computing and related-recent technologies, in the fields of distributed and mobile computing, multimedia computing, high performance computing along with information and network security. 2. Able to develop the concept of net-centric computing, parallel computing, distributed computing for analyzing and designing algorithms that can be used to solve computation problem in various fields and disciplinary of science.	
COURSE LEARNING OUTCOME	
1. Students are able to explain and assemble knowledge in the field of Network-Based Computing in terms of concepts, theories, and terms in a variety of supporting technology. 2. Students are able to provide a critical assessment of a problem in Network-Based Computing technology support. 3. Students are capable of analyzing and assessing the Network-Based Computing assistive technologies to be applied in the field of new / different. 4. Students are able to plan / find a scientific solution to resolve the problems in the field of assistive technologies Network-Based Computing.	
MAIN SUBJECT	
Discussion and introduction of technology and research in the field areas: Wireless Network, Mobile Computing, Distributed Systems, Cloud Computing, Network Security and Multimedia Network.	
PREREQUISITES	
-	
REFERENCE	
1. Stallings, W., "Wireless Communications and Networking 2nd Edition", Prentice Hall, 2004. 2. Abdessalam Helal, et. al," Anytime, Anywhere Computing, Mobile Computing Concepts and	



Technology", McGraw-Hill.

3. Richard Hill, "Guide to Cloud Computing, Principles and Practice", Springer.
4. Cryptography and Network Security: Principles and Practice (6th Edition) by William Stallings (Mar 16, 2013).
5. Secure Coding in C and C++ (2nd Edition) (SEI Series in Software Engineering) by Robert C. Seacord (Apr 12, 2013).
6. Coleman, D., Westcott, D., "CWNA: Certified Wireless Network Administrator Official Study Guide", Wiley Publishing Inc., 2009.
7. Schiller, J.H., "Mobile Communications 2nd Edition", Addison-Wesley, 2004.
8. Mobile Computing Principles Designing And Developing Mobile Applications With Uml And Xml and the Environment", Oxford Publisher 2002.
9. Location Management and Routing in Mobile Wireless Networks, Amitava Mukherjee, Somprakash Bandyopadhyay, Debashis Saha, Artech House Publisher
10. Andreas Heinemann, Max Muhlhauser", Peer-to-Peer Systems and Application
11. Mohammad Ilyas and Imad Mahgoub, Mobile Computing Handbook, Auerbach Publication
12. George Coulouris, Distributed Systems, Concepts and Design 3rd edition Addison-Wesley, 2001
13. Biometric Cryptography Based on Fingerprints: Combination of Biometrics and Cryptography Using Information from fingerprint by Martin Drahansky (May 23, 2010).
14. Information Security The Complete Reference, Second Edition by Mark Rhodes-Ousley (Apr 3, 2013)
15. IEEE Transactions on Mobile Computing, IEEE
16. Pervasive and Mobile Computing, Elsevier
17. IEEE Transactions on Cloud Computing, IEEE
18. IEEE Transactions on Network Science and Engineering, IEEE
19. IEEE Transactions on Services Computing, IEEE
20. IEEE Transactions on Parallel & Distributed Systems, IEEE

COURSE	Course Name: Software Engineering
	Course Code : IF185103
	Credit : 3
	Semester : 1
DESCRIPTION OF COURSE	
Software engineering study about aspects related to method.	
GRADUATE LEARNING OUTCOMES	
1. Mastering theory and application theory of design and development of software using standardized and scientific methods of planning, requirement engineering, design, implementation, testing, and product releasing, to produce software products that meet various parameters of quality, i.e. technical, managerial, and efficient.	
2. Capable of modelling, analyzing, and developing software using software engineering process principles to produce software that meets both technical and managerial qualities.	
COURSE LEARNING OUTCOME	
Students are able to organize the road map of software engineering research.	
MAIN SUBJECT	
1. Concept and principle of Software Engineering: software concept, SDLC, types of application.	
2. Software engineering approach on specific systems: real time system, client-server system, distributed system, Parallel system, web-based system, high integrity system, games, mobile computing, and domain specific (business application and scientific computing).	
3. Issues of each specific system: project management effectively and efficiently, software quality, process business, software process improvement.	
PREREQUISITES	



-
REFERENCE
1. Pressman, R.S., Software Engineering: A Practitioner's Approach, 8th Edition, McGraw-Hill, 2006.
2. Sommerville, I., Software Engineering 8th Edition, Addison Westley, 2007.
3. Articles in Scientific Journals related to Software Engineering.
4. Others supporting references given during lecturer.

COURSE	Course Name: Research Methodology
	Course Code : IF185201
	Credit : 3
	Semester : 2
DESCRIPTION OF COURSE	
The research methodology or the systematic study of the stages of the scientific method in developing a research. The output of this course is draft of research proposals associated with each research topic.	
GRADUATE LEARNING OUTCOMES	
Being able to develop logical, critical, systematic, and creative thinking through scientific research, the creation of designs or works of art in the field of science and technology which concerns and applies the humanities value in accordance with their field of expertise, prepares scientific conception and result of study based on rules, procedures and scientific ethics in the form of a thesis or other equivalent form, and uploaded on a college page, as well as papers published in scientific journals accredited or accepted in international journals;	
COURSE LEARNING OUTCOME	
Students are able to do the stages in developing a research method research to produce good research proposal.	
MAIN SUBJECT	
Scientific methodology consisted of how to do a literature review, analysis and formulation of the problem, determining the purpose and scope of the study, design and implementation of the proposed method, how to test the correctness and validity, as well as the conclusions.	
PREREQUISITES	
-	
REFERENCE	
-	

COURSE	Course Name: Advance topics in Network Design and Audit
	Course Code : IF185911
	Credit : 3
	Semester : 1
DESCRIPTION OF COURSE	
Student learns to analyze and design computer network with correct methodology and doing computer network audit.	
GRADUATE LEARNING OUTCOMES	
1. Mastering theory and application theory of architecture and network computer principles.	
2. Able to model computer architecture and principles of operating system tasks to develop and manage network system with high performance, safety, and efficient.	
COURSE LEARNING OUTCOME	
1. Students capable of analyzing and designing computer networks.	



2. Student also capable of auditing existing computer networks with correct methodology.
MAIN SUBJECT
1. REQUIREMENT ANALYSIS: User, application, device, network, and other requirements concept and process.
2. FLOW ANALYSIS: Data Sources and Sinks, Flow Model, Flow Prioritization.
3. NETWORK ARCHITECTURE: Network, routing, addressing, network 14 management, performance, security, and privacy architecture.
4. NETWORK DESIGN: Design concept, process concept, evaluation, network layout, metrics.
PREREQUISITES
-
REFERENCE
McCabe, J., "Network Analysis, Architecture, and Design 3rd Edition", Morgan Kauffman, 2007.

COURSE	Course Name: Advance topics in Cyber Security
	Course Code : IF185912
	Credit : 3
	Semester : 2
DESCRIPTION OF COURSE	
Students learn, analyze, and extend techniques in the field of cyber security, and applying it for certain fields. In its process, this subject takes case studies to enrich the student's knowledge.	
GRADUATE LEARNING OUTCOMES	
1. Able to improve intelligent system concepts and computational science to produce intelligent applications in various scientific fields and disciplines.	
2. Able to improve network architecture concepts and network-based computing principles with high performance and security.	
3. Able to work and communicate effectively both individually and in groups.	
4. Able to improve logical, critical, systematic, and creative thinking through scientific research in the field of science and technology-based on scientific principles, procedures, and ethics in the form of theses and papers published in seminars or scientific journals at both national and international levels.	
COURSE LEARNING OUTCOME	
1. Students understand and are able to analyze the concept of cyber security, along with factors that affect the security of the systems.	
2. Students are able to analyze techniques for protecting data in various environments.	
3. Students are able to extend and implement a technique for securing data based on previous methods.	
4. Students are able to analyze the experimental results and write them in an academic report.	
MAIN SUBJECT	
1. Concept of cyber security, include the factors that affect the security of the systems.	
2. Techniques or methods for protecting and securing data.	
PREREQUISITES	
Computer Networks	
REFERENCE	
1. Cyber Forensics: From Data to Digital Evidence (Wiley Corporate F&A) by Albert J. Marcella Jr. and Frederic Guillosoy (May 1, 2012).	
2. Network Forensics: Tracking Hackers through Cyberspace by Sherri Davidoff and Jonathan Ham (Jun 23, 2012).	
3. Introduction to Security and Network Forensics by William J. Buchanan (Jun 6, 2011).	
4. Digital Forensics and Cyber Crime: 4th International Conference, ICDF2C 2012, Lafayette,	



- IN, USA, October 25-26... by Marcus K. Rogers and Kathryn C. Seigfried-Spellar (Oct 7, 2013).
5. Digital Forensics with Open-Source Tools by Cory Altheide and Harlan Carvey (Apr 28, 2011).

COURSE	Course Name: Advance topics in Modeling and Simulation
	Course Code : IF185921
	Credit : 3
	Semester : 1
DESCRIPTION OF COURSE	
Modeling and simulation systems study aspects related to the modeling and simulation of simple problems, solve variations of problem that related to simple problems that contains various probability distributions and create alternative simulation models for the problems encountered.	
GRADUATE LEARNING OUTCOMES	
1. Mastering theory and application theory to solve computation problems by using linear and non linear optimization, modelling and simulation; 2. Able to model, analyze and develop solution of computation problems, and mathematical modelling through exact, stochastic, probabilistic, and numeric approaches effectively and efficiently;	
COURSE LEARNING OUTCOME	
1. Students capable to explain modeling concepts and modeling abstraction on the problems 2. Students capable to explain the relationship between modeling and simulation 3. Students capable to create simulation models of simple problems with a spreadsheet 4. Students capable to explain the role of probability distribution and visualization in modeling and simulation 5. Students capable to solve variations of problem related to simple problems that contain various probability distributions 6. Students capable to perform an output analysis 7. Students capable to compare the outputs of simulation models 8. Students capable to perform input modeling 9. Students capable to create simulation models using simulation tools 10. Students capable to create an alternative simulation model for the problem encountered 11. Students capable to analyze alternative simulation models for the problems encountered 12. Students capable to examine research papers on the topic of systems simulation and presents the results 13. Students capable to create an alternative simulation model for the problem encountered 14. Students study and understand the contemporary research topics in the field of systems simulation	
MAIN SUBJECT	
1. Modeling and simulation concepts. 2. Problem solving with simulation, benefits of using simulation, linkage of modeling and simulation. Sample case. 3. Basic simulation with spreadsheets, Monte Carlo simulation. Sample case. 4. Statistical model in simulation. Sample case. 5. Steady-state simulation, Confidence interval with the desired accuracy 6. Output comparison of two simulations. Sample case. 7. Data Collection, identifying data distribution, estimating parameters, goodness-of-fit test. Sample case. 8. Creating model and simulation model execution using simulation tools	



9. Create an alternative simulation model and compare it with the desired performance. Sample case.
10. Analyze simulation output and compare with desired performance. Sample case.
11. Research papers on the topic of simulation systems
12. Analyze simulation output and compare with desired performance
13. Research papers on the topic of systems simulation
PREREQUISITES
-
REFERENCE
1. Banks, Jerry., John S Carson. Berry L Nelson. David M Nicol. "Discrete Event system Simulation", 5th Edition. Pearson Education. 2010.
2. Law, Averill M., W David Kelton. "Simulation Modelling and Analysis", 3rd Edition. McGraw Hill. New York. 2000.
3. Joko Lianto Buliali, "Dasar Pemodelan dan Simulasi Sistem", ITSPress, Surabaya, 2013.
4. James R. Evans, David L. Olson (Author), "Introduction to Simulation and Risk Analysis", McGraw-Hill, Ltd., 1998.

COURSE	Course Name: Advance topics in Time series Data Analysis
	Course Code : IF185922
	Credit : 3
	Semester : 2
DESCRIPTION OF COURSE	
This course give knowledge and prespective to student about several problems representing time series form, and give knowledge about methods that are used to obtain optimal solution from those problems.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering theory and application theory for solving computational problems using linear and non-linear optimization as well as modeling and simulation; 2. Able to model, analyze and develop computational problem solving and mathematical modeling through exact, stochastic, probabilistic and numerical approaches effectively and efficiently;	
COURSE LEARNING OUTCOMES	
1. Students are able to understand the concept of time series problems; 2. Students are able to understand linear optimization problems; 3. Students are able to understand optimization problems without a limiting function; 4. Students are able to understand non-linear optimization problems.	
MAIN SUBJECT	
1. Time Series and Forecasting Basics 2. Linear Processes 3. State Space Models 4. Spectral Analysis 5. Estimation Methods 6. Nonlinear Time Series 7. Prediction 8. Nonstationary Processes 9. Seasonality 10. Time Series Regression 11. Discussion of research papers on new methods in time series problems.	
PREREQUISITES	
-	



REFERENCES

1. Ratnadip Adhikari, Agrawal R. K., R. K. Agrawal, *An Introductory Study on Time Series Modeling and Forecasting*, Lambert Academic Publishing GmbH KG, 2013 - 76 pages;
2. Palma, Wilfredo, *Time Series Analysis*, John Wiley & Sons, 2016;
3. Harya Widiputra, *Multiple Time-Series Analysis and Modelling: An Adaptive Integrated Multi-Model Framework*, Lambert Academic Publishing, 2012;

COURSE	Course Name : Topics in Human and Computer Interaction
	Course Code : IF185931
	Credit : 3 Credits
	Semester : 1
COURSE DESCRIPTION	
This course is an introduction to research on the topic of Human and Computer Interaction (HCI). This course introduces the theories of human physiology and psychology, the principles of human-computer interaction, the user-focused application development process, the stages of research in the HCI field, and the implementation of experimentation and evaluation in research in the HCI field. Through this course, students will have the opportunity to further explore research topics in the field HCI.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering computer graphics application theory and theory including modeling, rendering, animation and visualization, as well as mastering the theory and application theory of human and computer interactions; 2. Able to model, analyze and develop applications using the principles of computer graphics including modeling, rendering, animation and visualization, as well as applying the principles of human and computer interaction and evaluating the efficiency of building applications with a suitable interface;	
COURSE LEARNING OUTCOMES	
1. Students are able to report and discuss the latest research in the HCI field. 2. Students are able to understand the importance of human physiological and psychological factors and their effects on human and computer interactions. 3. Students are able to understand basic knowledge of interactions between humans and computers. 4. Students are able to apply HCI principles, guidelines, methodologies and techniques for user-centered software or information system development. 5. Students are able to conduct evaluation and usability studies on HCI. 6. Students are able to provide criticism on HCI designs belonging to other people or parties.	
MAIN SUBJECT	
1. Introduction to HCI and the history of the development of HCI research topics over time. 2. Assessment of aspects of human physiology and psychology (Human Factor) such as sensory, motor and cognitive characteristics in relation to HCI. 3. The study of the elements of interaction: display and control relations, mental models and metaphors, interaction errors. 4. User-focused application development process. 5. Introduction to the basic and stages of research in the HCI field: research methods, observation and measurement, validation, and evaluation. 6. Perancangan metodologi dan eksperimen pada penelitian di bidang HCI. 7. Evaluation and hypothesis testing in HCI research. 8. Writing research publications in the HCI field.	
PREREQUISITES	
-	
REFERENCES	



5. MacKenzie, I. Scott. Human-computer interaction: An empirical research perspective. Newnes, 2012.
6. Alan Dix, Janet E. Finlay, Gregory D. Abowd, and Russell Beale. Human-Computer Interaction (3rd Edition). Prentice-Hall, Inc., Upper Saddle River, NJ, USA. 2003.
7. Lazar, Jonathan, Jinjuan Heidi Feng, and Harry Hochheiser. Research methods in human-computer interaction. John Wiley & Sons, 2010.

COURSE	Course Name : Topics in Game Development, Virtual Reality and Augmentation Reality
	Course Code : IF185932
	Kredit : 3 Credits
	Semester : 2

COURSE DESCRIPTION

In this course, students will discuss and learn about the history of game development and technology, get to know various popular games available and classifications based on genres and other classifications. The next stage will study and analyze how the game development process, *theory of fun* and educational value in games. Until the end of the lecture, students and their team will be able to implement simple educational game making. Virtual Reality studies aspects related to the development of virtual reality, augmented reality, and mixed reality. Understand the input and output elements present in virtual reality and optical modeling to produce stereoscopic views. Creating modeling and programming in virtual reality as well as 3-dimensional virtual reality applications using a game engine.

GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE

1. Mastering computer graphics application theory and theory including modeling, rendering, animation and visualization, as well as mastering the theory and application theory of human and computer interactions;
2. Able to model, analyze and develop applications using the principles of computer graphics including modeling, rendering, animation and visualization, as well as applying the principles of human and computer interaction and evaluating the efficiency of building applications with a suitable interface;

COURSE LEARNING OUTCOMES

1. Students are able to analyze and classify games based on genre, theme and rating.
2. Students are able to explain and analyze the educational value in a game.
3. Students are able to form teams and make simple educational games.
4. Students are able to understand advanced theories of Virtual Reality (VR) and Augmented Reality (AR).
5. Students are able to create 3D VR and AR applications.

MAIN SUBJECT

Basic theory of game development, game development process, Game Design Document (GDD), game middleware, educational games, theory of fun

Introduction to Virtual Reality

1. History of the development of Virtual Reality
2. Benefits of Virtual Reality
3. General Virtual Reality Systems
4. Virtual environment

3D Computer Graphics

5. Transformation and 3D world, Object modeling, object dynamics
6. Physical Modeling: Constraints
7. Impact detection, Surface deformation
8. Perspective view
9. Stereoscopic vision



Perangkat keras VR 10. Input Device 11. Output Device VR Software Device 12. Virtual environment construction 13. Graphics Rendering 14. Interaction in virtual environments 15. Collision Detection 16. Collision Response 17. The power of feedback 18. Haptic Interface Human Factor 19. Sight and Appearance 20. Hearing and Touch Health and Safety Issues
PREREQUISITES
-
REFERENCES
1. Arnest Adam, "Fundamentals of Game Design", New Riders Press, 2nd Edition 2010 2. David Michael, "Serious Games, Games that Educate, Train and Inform", Thomson Course Tech, 2005 3. Grigore, C Burdea & Philippe, Coiffet, "Virtual Reality Technology", Wilye Interscience, 2003 4. William R. Sherman, Alan B.Craig, "Understanding Virtual Reality", Morgan-Kaufmann, Inc., 2003. 5. Theory of Fun for Game Design, Ralph Koster, 2nd Edition Nov 2013. 6. "Learning and Teaching with Computer Games", aace.org

COURSE	Course Name : Topics in Computer Graphics
	Course Code : IF185933
	Kredit : 3 credits
	Semester : 2
COURSE DESCRIPTION	
Computer Graphics studies aspects related to the development of curve and surface modeling, Scattered-data approximation, curve and surface analysis and design, rendering, and animation.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering computer graphics application theory and theory including modeling, rendering, animation and visualization, as well as mastering the theory and application theory of human and computer interactions; 2. Able to model, analyze and develop applications using the principles of computer graphics including modeling, rendering, animation and visualization, as well as applying the principles of human and computer interaction and evaluating the efficiency of building applications with a suitable interface;	
COURSE LEARNING OUTCOMES	
Students are able to apply curve and surface models to various rendering techniques, visualization systems, animation techniques, and CAD systems.	
MAIN SUBJECT	
1. Curve and surface modeling 2. Scattered-data approximation 3. The model for the design analysis of curves and surfaces	



4. Rendering technique
5. Animation technique.
PRASYARAT
-
PUSTAKA
1. Computer Animation: Algorithms and Techniques. Rick Parent, Morgan Kaufmann, Third edition 2012
2. G. Farin, <i>Curves and Surfaces for CAGD</i> , Academic Press, 1997.
3. FS Hill Jr, " <i>Computer Graphics using OpenGL</i> ".
4. Proceeding of ACM SIGGRAPH.

COURSE	Course Name : Topic in Multimedia Networking
	Course Code : IF185941
	Kredit : 3 credits
	Semester : 1
COURSE DESCRIPTION	
This course discusses multimedia data and its format, along with data security methods: cryptography, steganography and watermarking. In addition, it also discusses data compression and the latest technology in multimedia networks.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security; 2. Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
Students are able to understand the concept of multimedia networks, both in the form of text, image, audio and video data, in terms of network and security. Based on these concepts, students are able to develop them further, either individually or in groups in teams.	
MAIN SUBJECT	
1. Visual data format: DCT and wavelet based systems. 2. Data security basics: cryptography, steganography, watermarking. 3. Compression of multimedia data.	
PREREQUISITES	
-	
REFERENCES	
1. Image and Video Encryption: From Digital Rights Management to Secured Personal Communication (Advances in Information security) by Andreas Uhl and Andreas Pommer (Feb 12, 2010). 2. Image and Video Processing in the Compressed Domain by Jayanta Mukhopadhyay (Mar 22, 2011) 3. Multimedia Communications and Networking by Mario Marques da Silva (Mar 14, 2012) 4. Fundamental Data Compression by Ida Mengyi Pu (Jan 11, 2006) 5. Cryptography and Network Security: Principles and Practice (6th Edition) by William Stallings (Mar 16, 2013)	



COURSE	Course Name : Topics in Distributed Systems
	Course Code : IF185942
	Kredit : 3 credits
	Semester : 1
COURSE DESCRIPTION	
Topics in distributed systems study aspects related to the development and management of distributed systems. This includes basic issues in distributed systems for example, replication, fault tolerance, consistency, scalability, isolation, privacy, and so on. Technical aspects related to distributed system development are also the study of this subject, for example communication direct / indirect, middleware, programming, distributed system security, and so on. In this course, current research issues in the development and management of distributed systems are also studied.	
LEARNING OUTCOMES OF THE SUPPORTED PROGRAM	
1. Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security; 2. Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
Students are able to design, develop and analyze distributed systems with limitations and constraints that arise in realizing the goals of developing the system.	
MAIN SUBJECT	
1. Introduction to distributed systems, concepts, goals, and limitations 2. Interprocess Communication: message passing, remote procedure call, distributed object and naming 3. Based programming distributed systems: socket UDP / TCP and the use of middleware 4. Indirect communication (publish subscribe and tuple space) 5. Middleware for distributed systems (middleware for publish subscribe, map reduce, peer to peer, and message queue) 6. Concepts, standards and middleware on a multi-agent and mobile agent 7. Distributed file systems and examples of application 8. Topics of research in mobile computing, pervasive computing, computing, ubiquitous and cloud computing 9. Research issues in distributed systems (load balancing, load estimation, load migration, and big data)	
PREREQUISITES	
Net-Centric Computing	
REFERENCE	
1. Coulouris, G., Dollimore, J., Kindberg, T., Blair, G., "Distributed Systems: Concepts and Design 5th Edition", Addison-Wesley, 2011 2. Varela, C.A., "Programming Distributed Computing Systems: A Foundational Approach", The MIT Press, 2013	

COURSE	Course Name : Topics In Digital Forensics
	Course Code : IF185943
	Kredit : 3 credits
	Semester : 1



COURSE DESCRIPTION	
Digital Forensics studies the concept of digital forensics, both computer forensics and network forensics.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security; 2. Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
Students are able to understand the concept of digital forensics, both computer forensics and network forensics. Based on these concepts, students are able to develop them further, and carry out evaluations, both individually and in groups in teams.	
MAIN SUBJECT	
1. Digital proof concept: real proof, best evidence, direct evidence, digital proof. 2. Forensic investigation methodology: obtaining information, strategizing, gathering evidence, analysis, reporting. 3. The collection of evidence: physical tapping (cable, radio frequency, etc.), software to get the data (tcpdump, wireshark, etc.) 4. File concept: file signature, forensic imaging, file allocation table (FAT), NTFS, volume, partition. 5. Technical basics: packet analysis, flow analysis, network-based evidence sources (firewalls, proxies, routers, switches, server logs etc.)	
PREREQUISITES	
-	
REFERENCES	
1. Cyber Forensics: From Data to Digital Evidence (Wiley Corporate F&A) by Albert J. Marcella Jr. and Frederic Guillosoy (May 1, 2012). 2. Network Forensics: Tracking Hackers through Cyberspace by Sherri Davidoff and Jonathan Ham (Jun 23, 2012). 3. Introduction to Security and Network Forensics by William J. Buchanan (Jun 6, 2011). 4. Digital Forensics and Cyber Crime: 4th International Conference, ICDF2C 2012, Lafayette, IN, USA, October 25-26... by Marcus K. Rogers and Kathryn C. Seigfried-Spellar (Oct 7, 2013) 5. Digital Forensics with Open Source Tools by Cory Altheide and Harlan Carvey (Apr 28, 2011).	

COURSE	Course Name : Topics in Network Security
	Course Code : IF185944
	Kredit : 3 credits
	Semester : 2
COURSE DESCRIPTION	
This course discusses the concept of network security. Included in this is the basic computer security, several methods of attack and anticipation.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security; 2. Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields	



and scientific disciplines;
COURSE LEARNING OUTCOMES
Students are able to understand the concept of network security. Based on these concepts, students are able to develop them further, either individually or in groups in teams.
MAIN SUBJECT
1. The basic concept of computer security, information system security, software security; Security properties: confidentiality, integrity, availability, authenticity, non-repudiation, scalability. 2. DDOS, session management, SQL injection, XSS, cookies 3. Symmetric and asymmetric methods; classical and modern encryption theories and examples, blocks and streams; use of substitution, transposition 4. Data security methods: hash function, steganography, MAC, digital signature. 5. Authentication method: password, token, fingerprint; principle of remote authentication; use of symmetric and asymmetric encryption for remote authentication; protocol: kerberos; federated identity 6. IDS, IPS, firewall types and characteristics 7. Use of VPN, IDS, firewall, honeypot
PREREQUISITES
-
REFERENCES
1. Cryptography and Network Security: Principles and Practice (6th Edition) by William Stallings (Mar 16, 2013). 2. Secure Coding in C and C++ (2nd Edition) (SEI Series in Software Engineering) by Robert C. Seacord (Apr 12, 2013). 3. Biometric Cryptography Based on Fingerprints: Combination of Biometrics and Cryptography Using Information from fingerprint by Martin Drahansky (May 23, 2010). 4. Information Security The Complete Reference, Second Edition by Mark Rhodes-Ousley (Apr 3, 2013).

COURSE	Course Name : Topics in Mobile Computing
	Course Code : IF185945
	Kredit : 3 credits
	Semester : 2
COURSE DESCRIPTION	
This course studies and analyzes issues related to system development in a mobile computing environment by understanding the characteristics of the environment and the infrastructure in which the system is located, moves, or interacts. This course also studies supporting technology and methodologies to solve related problems so that the objectives of system development are achieved.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security; 2. Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
Students are able to analyze, synthesize concepts, and be able to build systems that run in a mobile computing environment with an understanding of technology and related methodologies that support the development of these systems.	



MAIN SUBJECT
1. Wireless network technology and its limitations. 2. Characteristics and dimensions of systems that work in a mobile environment. 3. Modeling and characteristics of mobility in a mobile environment. 4. Location management by systems that work in a mobile environment. 5. Ad hoc and delay tolerant network and their limitations, routing, and its advantages. 6. Recent issues related to mobile information access, application adaptation related to location, energy, and availability of resources. 7. Development of Spontaneous Networking, mobile peer-to-peer, and its applications. 8. Various research topics in mobile computing.
PREREQUISITES
Net-Centric Computing
PUSTAKA
1. Ilyas, M., Mahgoub, I., "Mobile Computing Handbook", Auerbach, 2005 2. B'Far, R., "Mobile Computing Principles Designing and Developing Mobile Applications With UML and XML", Cambridge University Press, 2005 3. Steinmetz, R., Wehrle, K., "Peer-to-Peer Systems and Application", Springer, 2005 4. Mukherjee, A., Bandyopadhyay, S., Saha, D., "Location Management and Routing in Mobile Wireless Networks", Artech House Publisher, 2003 5. Helal, A.A., Haskell, B., Carter, J.L., Brice, R., Woelk, D., Rusinkiewicz, M., "Anytime, Anywhere Computing: Mobile Computing Concepts and Technology", Springer, 1999 6. IEEE Transaction of Mobile Computing, IEEE 7. Pervasive and Mobile Computing, Elsevier

COURSE	Course Name : Topics in Cloud Computing
	Course Code : IF185946
	Kredit : 3 credits
	Semester : 2
COURSE DESCRIPTION	
Cloud computing is a new paradigm in the information technology industry. Cloud computing technology is user-oriented in terms of services, providing computing resources in a transparent manner. This course will discuss the basics and introduction of cloud technology, its mechanisms, and architecture along with the latest technology and research in cloud computing.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security; 2. Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
1. Students are able to explain and arrange knowledge in the field of cloud computing in terms of concepts, theories, and terms in various kinds of supporting technologies. 2. Students are able to provide critical assessments of challenges and opportunities in Cloud Computing technology and its supporters. 3. Students are able to conduct and analyze and assess Cloud Computing technology and its supporters to be applied in new / different fields. 4. Students are able to plan / find a scientific solution to solve problems / challenges / problems in the field of cloud computing technology.	
MAIN SUBJECT	



Fundamentals introduction to cloud computing, security mechanisms and handling of cloud computing, architecture and delivery models in cloud computing, cloud computing supporting technologies, cases in cloud computing and their implementation. management on systems and service quality in cloud computing.

PREREQUISITES

-

REFERENCES

1. Thomas Erl et al, "Cloud Computing, Concepts, Technology. And Architecture". Prentice Hall.
2. Hill et al, "Guide to Cloud Computing, Principles and Practice". Springer.
3. George Coulouris, Distributed Systems, Concepts and Design 3rd edition Addison-Wesley, 2001
4. Tanenbaum wet all, "Distributed Systems. Principles and Paradigms", Prentice Hall.
5. IEEE Transactions on Mobile Computing, IEEE
6. IEEE Transactions on Cloud Computing, IEEE
7. IEEE Transactions on Services Computing, IEEE
8. IEEE Transactions on Parallel & Distributed Systems, IEEE

COURSE	Course Name : Topics in Wireless Network
	Course Code : IF185947
	Kredit : 3 credits
	Semester : 2
COURSE DESCRIPTION	
This course explains issues related to Wireless Networks, identifies and analyzes limitations and finds solutions, and discusses the development trends of Wireless Networks.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Mastering the theory and application theory of network-based computing and the latest technology related to it, in the field of distributed computing and mobile computing, multimedia computing, high-performance computing and information and network security; 2. Able to develop network-based computing concepts, parallel computing, distributed computing to analyze and design computational problem-solving algorithms in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
1. Students are able to identify issues related to Wireless Networks: challenges, limitations and developments. 2. Students are able to analyze existing limitations to find solutions. 3. Students are able to search and analyze several topics in wireless networks. 4. Students are able to write scientific papers that can be submitted at seminars or as a thesis proposal.	
MAIN SUBJECT	
1. Mobile and Wireless Systems Challenges: Evolution of telecommunication, computing, and mobile / wireless systems, models of mobile computing, Mobile and wireless systems, Challenges & problems: low power, variable bandwidth, mobility, security. 2. Wireless Channel: Allocation of radio spectrum and characteristics to different frequencies. Simple wireless channel model: propagation, path loss, multipath fading, interference source, packet radio link model, radio channel incapacity coping techniques: channel coding, equalization, diversity, smart antennas. 3. Sharing Wireless Link: Channels are shared on the dimensions of time, frequency and code, Static multiple access techniques: TDMA, FDMA, CDMA, Spread spectrum - direct sequence, frequency hopping, interference resistance, Packet-oriented MAC, hidden terminal, exposed terminal, random -access MAC: MACA, MACAW, CSMA / CA 802.11 DCFS mode, Controlled-access MAC: 802.11 PCFS mode, Bluetooth.	



4. Ad Hoc Wireless Networks - MANET: Wireless ad hoc networks, Classes of Wireless Ad Hoc Networks, Unicast Routing in MANET, Various MANET routing schemes: flooding, Dynamic Source Routing (DSR), Location Aided Routing (LAR), etc.
5. Sensor Network: Networked Sensor: Centralized & Distributed Approach, Sensor Network Characteristics, Sensor Protokol.
PREREQUISITES
Net-Centric Computing
REFERENCES
1. Tse, D. & Viswanath, P., Fundamentals of Wireless Communication; Cambridge University Press, 2005.
2. Rappaport, Theodore S., <u>Wireless Communications: Principles And Practice</u> ; Prentice Hall, 1995.
3. Kaser, S. & Narang, N., 3G Mobile Networks; McGraw-Hill, 2005.
4. Jurnal, Majalah, Proceeding di berbagai sumber.

Course	Course Name : Topics in Data Mining
	Course Code : IF185951
	Kredit : 3 credits
	Semester : 1
COURSE DESCRIPTION	
In this course, students learn about concepts, basic techniques, and general data mining, including cleaning data from noise, outliers, and duplication; data transformation including smoothing, normalization, and feature formation; data exploration and visualization; classification methods, handling imbalanced data, association rules mining; techniques clustering; and recommendation system application. As well as studying and applying data mining techniques on a variety of data types eg, text mining, multimedia mining database, data time series mining, mining, sequential data and mining data streams.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Students are able to master the theory and theory of intelligent systems applications which include representation and reasoning techniques, search techniques, intelligent agents, data mining, and machine learning, as well as the development of smart applications in various fields, and master the concepts and principles of computational science including information management, multimedia data processing, and numerical analysis; 2. Able to develop applications by applying the principles of intelligent systems and computational science to produce smart application products in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
1. Students are able to preprocess, explore and visualize data. 2. Students are able to understand the basic techniques and general data mining. 3. Students are able to apply data mining techniques in a variety of types of data on the real problems. 4. Students are able to examine some of the articles published in international publications on data mining	
MAIN SUBJECT	
1. Introduction to data mining, data mining tasks, data mining processes, data mining applications, data definition, types of attributes in data, variations in data types. 2. Data preprocessing • data quality: related to noise, outliers, missing values, and data duplication. • data cleaning: handling techniques noise, identification and removal of outliers, imputation techniques. • Data transformation: smoothing, normalization, aggregation, formation of features or	



attributes, and generalization
• data reduction: dimension reduction (pca, svd, lda), feature selection (filter, wrapper, hybrid), data sampling. • discretization of data: binning, entropy-based
3. Data exploration and visualization
• Statistical methods: the frequency or mode, percentile, mean and median, range and variance • visualization: histogram, box plot, scatter plot, contour plot, star plot, Chernoff face, with examples of application to dataset
4. Classification: classification methods (Nave Bayes, Decision Tree, SVM, Method Ensemble: Bagging, Boosting, Random Forest)
5. Handling of imbalanced data: undersampling, oversampling, SMOTE algorithm
6. Association rules: concept of association rules, frequent itemset, a algorithm priori, closed itemset, FP-algorithm growth, rule generation, mining with multiple minimum support
7. Clustering: jenis clustering, tipe-tipe klaster, algoritma clustering (Hierarchical-based, Density-based, Graph-based), validitas klaster, dan cara mengukurnya.
8. Recommender systems and collaborative filtering: recommendation system concept, recommendation types, content-based recommendations, techniques collaborative filtering.
9. Mining multimedia data: definition of multimedia data, CBIR, and application examples
10. Mining time series and sequential data: definition of data time series and sequential, trend analysis, similarity analysis and some application examples
11. Mining data stream: data stream definition, model, and application examples; data extraction techniques stream (sliding window, counting bits, DGIM)
PREREQUISITES
Computational intelligence
REFERENCES
1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson Education (Addison Wesley), 2006.
2. Jiawei Han and Micheline Kamber, "Data mining: Concepts and Techniques", Morgan Kaufmann Publishers, 2011.
3. Anand Rajaram, Jure Leskovec and Jeff Ullman, " Mining of Massive Data Sets ", Cambridge University Press, 2011.
4. Ian H. Witten, Eibe Frank and M. Hall Morgan Kaufmann, "Data mining - practical machine learning tools and techniques with Java implementations", 3 rd edition, 2011
5. Artikel dalam jurnal IEEE Transactions on Knowledge and Data Engineering, IEEE Computer Society.
6. Artikel dalam jurnal ACM Transactions on Knowledge Discovery from Data, ACM Society.

COURSE	Course Name : Topics in Information Retrieval Systems
	Course Code : IF185952
	Kredit : 3 credits
	Semester : 1
COURSE DESCRIPTION	
In this course students will learn about various text data processing techniques to retrieve information in text-form data. Students are expected to be able to design, analyze and apply information retrieval system methods to real problems and raise them in a study with a multidisciplinary approach either independently or teamwork.	
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE	
1. Students are able to master the theory and theory of intelligent systems applications which include representation and reasoning techniques, search techniques, intelligent agents, data mining, and machine learning, as well as the development of intelligent applications in	



various fields, and master the concepts and principles of computational science including information management, multimedia data processing, and numerical analysis;	
2. Able to develop applications by applying the principles of smart systems and computational science to produce smart application products in various fields and scientific disciplines;	
COURSE LEARNING OUTCOMES	
1. Students are able to explain various concepts, theories, terms in various models of information retrieval systems and their applications	
2. Students are able to implement problem solving techniques such as indexing, searching, query processing in the need of information retrieval	
3. Students are able to create a search engine for information extraction as an example of simple implementation and categorize results for easy visualization	
4. Students are able to analyze the need for information grouping for easy retrieval using classification or clustering techniques	
5. Students are able to apply one of the choice of information retrieval techniques such as Latent Semantic Indexing, social data analysis, text summarization, user recommendations / profiles as a result of paper analysis from related research.	
MAIN SUBJECT	
Retrieval model with boolean, vector space, probabilistic, Lucene library, performance evaluation, relevance feedback, web search, classifying and clustering, applications: image-based retrieval, latent semantic indexing, recommendation system, information extraction.	
PREREQUISITES	
Kecerdasan Komputasional	
REFERENCES	
1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search 2nd Ed", Addison-Wesley, New Jersey, 2011	
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press, 2008	
3. IEEE Transactions on Knowledge & Data Engineering	
4. ACM Transactions on Asian Language Information Processing	
5. ACM Transactions on Knowledge Discovery from Data	
6. Special Interest Group on Information Retrieval	

COURSE	Course Name : Topics in Digital Image Processing
	Course Code : IF185953
	Kredit : 3 credits
	Semester : 2
COURSE DESCRIPTION	
1. Students learn digital image preprocessing such as contrast improvement, equalization of illumination, removal of reflections, and noise.	
2. Students learn Fourier transform, FFT, wavelet, and Hough transform.	
3. Students learn image filtering in the frequency domain, the image restoration process to improve visually degraded images or geometric image registration and the zooming process.	
4. Students apply digital image preprocessing and image processing in the frequency and wavelet domains, and analyze related research results.	
5. Students learn segmentation using various methods, both based on margins, threshold values, and regions.	
6. Students learn a variety of feature extraction methods to be used as feature vectors in pattern classification.	
7. Students learn classification methods with artificial neural networks, clustering, neurofuzzy, Bayesian.	
8. Students apply digital image feature extraction and classification and analyze related	



research results.
GRADUATE LEARNING OUTCOMES CHARGED FOR COURSE
1. Students are able to master the theory and theory of intelligent systems applications which include representation and reasoning techniques, search techniques, intelligent agents, data mining, and machine learning, as well as the development of intelligent applications in various fields, and master the concepts and principles of computational science including information management, multimedia data processing, and numerical analysis; 2. Able to develop applications by applying the principles of smart systems and computational science to produce smart application products in various fields and scientific disciplines;
COURSE LEARNING OUTCOMES
Students are able to apply digital image classification starting from pre-process and analyze related research results, both with individual performance and in teamwork.
SUBJECT
1. DIGITAL IMAGE PRAPROCESS: contrast enhancement, equalization of illumination, elimination of reflections and noise.. 2. IMAGE TRANSFORMATION: Fourier transform, wavelet, Hough transform.. 3. IMAGE FILTERING IN DOMAIN FREQUENCY AND RESTORATION PROCESSES. 4. APPLICATION OF DIGITAL IMAGE PROCESSES AND PAPER ANALYSIS OF RELATED RESEARCH RESULTS. 5. SEGMENTATION METHODS WITH VARIOUS METHODS: methods based on margins, threshold values, and areas. 6. EXTRACTION METHOD FEATURES: boundary descriptor, Fourier descriptor, topological descriptor, moment, texture. 7. CLASSIFICATION METHOD: artificial neural network, clustering, neurofuzzy, Bayesian. 8. Application of digital image feature extraction and classification, analysis of papers from related research. 9. Application of digital image classification model in group project. 10. Analysis of the results of applying and improving the model.
PREREQUISITE
Computational Intelligence
REFERENCES
1. Gonzales, R.C., and Woods, R. E., "Digital Image Processing", Prentice Hall, 2008 2. Pratt, W.K., "Digital Image Processing", John Wiley & Sons, Inc., 2007 3. Journal: a. IEEE Transactions on Pattern Analysis and Machine Intelligence b. Medical Image Analysis, www.sciencedirect.com c. IEEE Transactions on Medical Imaging 4. Forsyth, David A., and Ponce, Jean, "Computer Vision: A Modern Approach", 2nd Ed., Pearson Education, Inc., 2012 5. Petrou, Maria, and Petrou, Costas, "Image Processing: The Fundamentals", John Wiley & Sons Ltd, 2010 6. Costaridou, Lena (Ed.), "Medical Image Analysis Methods", Taylor & Francis Group, 2005 7. Russ, John C., "The Image Processing Handbook", fifth edition, CRC Press, 2007.

COURSES	Course Name : Topics In Computer Vision
	Course Code : IF185954
	Credit : 3
	Semester : 2
COURSES DESCRIPTION	
This course discusses comprehensive knowledge of computer vision (computer vision). Topic areas covered include image processing, physics concepts in image formation, geometry (tracking and reconstruction), and statistical methods for detection and classification. In	



addition, students will also explore advanced topics in the field of computer vision through the study of related papers.

GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE

1. Students are able to master the theory and theory of intelligent system application which includes representation and reasoning techniques, search techniques, intelligent agents, data mining, and machine learning, as well as the development of smart applications in various fields, and master the concepts and principles of computational science including management information, multimedia data processing, and numerical analysis;;
2. Able to develop applications by applying the principles of intelligent systems and computational science to produce smart application products in various fields and scientific disciplines;

COURSE LEARNING OUTCOMES

1. Students are able to analyze the concept of digital image processing for real problems.
2. Students are able to analyze geometric concepts to solve tracking and reconstruction problems.
3. Students are able to analyze statistical methods for object recognition.
4. Students are able to do independent research on certain topics, write research reports with a small scope, and present them orally.
5. Students are able to criticize various methods to solve computer vision problems.

SUBJECT

1. Image Processing: Pyramid Image, Edge Detection, Hough Transform.
2. Physics Based Vision: Appearance and BRDF, Photometric Stereo, Shape from Shading, Direct and Indirect Illumination.
3. Tracking and Reconstruction: Image Formation and Projection Geometry, Optical Flow, Image Alignment and Tracking, Binocular Stereo, Structured Light Range Imaging, Photo-tourism and Internet Stereo.
4. Statistical methods: Principal Component Analysis, Feature Detection (BLOB and SIFT), classification.
5. Recent Researches: Image Based Rendering, Open Challenges in Computer Vision.

PREREQUISITE

Computational Intelligence

REFERENCES

1. David A. Forsyth dan Jean Ponce, "Computer Vision: A Modern Approach, 2nd Edition", Prentice Hall, 2012.
2. Christian Wöhler, "3D Computer Vision: Efficient Methods and Applications", Springer-Verlag, Berlin Heidelberg, 2009.
3. Francisco Escolano, Pablo Suau, Boyán Bonev, "Information Theory in Computer Vision and Pattern Recognition", Springer Verlag, London, 2009.
4. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer-Verlag, London, 2011.

COURSES	Course Name : Topics in System Audit
	Course Code : IF185961
	Credit : 3
	Semester : 1
COURSES DESCRIPTION	
Topics in System Audit System audit studies the concept of information technology auditing and the function of control procedures. This lecture discusses the understanding of information control procedures, various types of control procedures and their effects on organizations, as well as how to manage control procedures and audit them. The lecture also studied planning and activities carried out to determine the effectiveness of an	



implementation by means of investigation, testing, evaluation of the maturity and appropriateness of standard procedures and regulations that apply in information technology governance.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Mastering theory and application theory for the development of the process of gathering, processing and storing information in various forms; 2. Able to develop techniques and algorithms for collecting, digitizing, representing, transforming, and presenting information, for efficient and effective information access;	
COURSE LEARNING OUTCOMES	
1. Students are able to understand the role and objectives of information technology audits 2. Students are able to build an audit process that suits enterprise requirements 3. Students are able to identify process and information risks related to confidentiality, integrity and availability 4. Students are able to design and implement procedures and control measures to manage risk effectively. 5. Students are able to make recommendations for improving system performance by referring to best practice examples, standards and regulations on information technology governance. 6. Students are able to build disaster recovery and business continuity plans.	
SUBJECT	
Planning and audit activities. Methods of investigation, testing, evaluation of maturity and appropriateness against standard procedures and applicable documents. Recommendations for improving the effectiveness of risk management, control and system governance processes.	
PREREQUISITE	
-	
REFERENCES	
1. Riyanarto Sarno, Audit Sistem Informasi/Teknologi Informasi, ITS Press, 2009. 2. Riyanarto Sarno, Strategi Sukses Bisnis dengan Teknologi Informasi Berbasis Balanced Score card dan COBIT, ITS Press, 2009, ISBN 978-979-8897-42-9. 3. Simha R. Magal, Integrated Business Processes with ERP Systems, John Wiley & Sons, Inc., 2012 4. Riyanarto Sarno & Irsyat Iffano, Sistem Manajemen Keamanan Informasi, ITS Press, 2009. 5. ISO, Information Technology – Security Techniques – Information Security Management Systems ISO/IEC 27001:2005, Switzerland, 2005. 6. ISACA, The IT Governance Institute, COBIT 5, USA, 2012.	

COURSES	Course Name : Topics In Knowledge Based Systems Engineering
	Course Code : IF185962
	Credit : 3
	Semester : 2
COURSES DESCRIPTION	
This course studies the concepts and stages in knowledge engineering, knowledge representation from real problem analysis into the scope of knowledge engineering, model design, implementation of knowledge engineering to computer systems either independently or in teamwork, and explores the renewal of the topics. related and able to define research topics in the field of knowledge engineering.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Mastering theory and application theory for the development of the process of gathering, processing and storing information in various forms;	



2. Able to develop techniques and algorithms for collecting, digitizing, representing, transforming, and presenting information, for efficient and effective information access;
COURSE LEARNING OUTCOMES
1. Able to understand the use of basic theories and techniques introduced within the scope of knowledge engineering so that they can be applied to real problems..
2. Able to analyze data and information to define a knowledge-based model of a computer system. Students are able to implement model designs in a computer system that manages knowledge.
3. Able to work together in solving real problems related to knowledge engineering from analysis to implementation.
4. Able to explore research topics in the field of knowledge engineering..
5. Able to define topics or research ideas in the field of knowledge engineering.
SUBJECT
1. Introduction to Knowledge Engineering: Data, information and knowledge, knowledge gaining techniques, knowledge modeling techniques.
2. Knowledge Acquisition: definition of knowledge acquisition, methods and techniques for knowledge acquisition, recent research in knowledge acquisition.
3. Knowledge validation: definitions, parameters and processes of validation measurement, techniques and methods of validation of knowledge and current research in knowledge validation.
4. Knowledge Representation: definitions, knowledge engineering processes, techniques in knowledge engineering, and current research related to knowledge representation.
5. Inference, Explanation & Justification
6. Semantic Web: semantic web roadmap, ontology and knowledge representation on semantic web, semantic web education.
7. Discussion of papers with related topics
PREREQUISITE
-
REFERENCES
1. Simon Kendal and Malcolm Creen, <i>an Introduction to Knowledge Engineering</i> , Springer, 2006.
2. R.J. Brachman and H.J. Levesque, <i>Knowledge Representation and Reasoning</i> , Elsevier 2004. (chapter 1-7)
3. Segaran, Evans, and Taylor, <i>Programming the Semantic Web</i> , O'Reilly, 2009.
4. P. Jackson, <i>Introduction to Expert Systems</i> , Addison-Wesley, 1999.
5. Jeffrey T Pollock, <i>Semantic Web for Dummies</i> , Wiley Publishing, Inc., 2009.
6. Devedziq, Vladan, <i>Semantic Web and Education (Integration Series in Information System)</i> , Springer-Verlag, 2006.
7. Makalah-makalah terkait akan diberikan kemudian di kelas.

COURSES	Course Name : Topics in Geospatial Data Analysis
	Course Code : IF185963
	Credit : 3
	Semester : 2
COURSES DESCRIPTION	
This course learns the basics of earth modelling and geospatial data processing, spatial data analysis to make decisions, and Developing Location-based services.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Able to improve methods for managing data and information in various forms.	
2. Internalize values, norms, and academic ethics and demonstrate an independent attitude of responsibility for work in their field of expertise.	



3. Able to work and communicate effectively both individually and in groups.
COURSE LEARNING OUTCOMES
1. Understand the fundamentals of earth modeling and geospatial data processing.
2. Able to perform spatial data analysis for decision making.
3. Able to develop the location-based services.
SUBJECT
1. Map Projection and Coordinate System Analysis
2. Map Digitizing Analysis
3. GPS Analysis
4. Remote Sensing – Thematic Map Analysis
5. Spatial Analysis
6. 3-D Analysis
7. Community-based Mapping Analysis
8. Location-based Services Analysis
PREREQUISITE
-
REFERENCES
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
3. Quantum GIS, online resources (www.qgis.org)
4. OpenStreetMap, online resources
5. Google Map API, online resources

COURSES	Course Name : Topics In Software Evolution
	Course Code : IF185971
	Credit : 3
	Semester : 1
COURSES DESCRIPTION	
In this course, students will learn about definitions and activities in the field of software evolution, as well as techniques in doing them. At the end of the lecture, students are expected to be able to bring up new thesis topics in the field of software evolution.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Mastering theory and application theory in software design and development with standard and scientific methods of planning, requirements engineering, designing, implementing, testing, and launching, to produce software products that meet various technical and managerial quality parameters, and are efficient in software development.	
2. Able to model, analyze and develop software using the principles of software engineering processes to produce software that meets both technical and managerial quality;	
COURSE LEARNING OUTCOMES	
1. Able to explain the definition and activities in the field of software evolution.	
2. Able to explain the definition, method and application of cloning in software evolution.	
3. Able to explain the definition, method, and application of software repositories in software evolution.	
4. Able to explain the definition, method, and application of error prediction from history and software development logs..	
5. Able to explain the definition, method, and object-oriented reengineering application.	
6. Able to come up with new thesis topics in the field of software evolution.	
SUBJECT	
1. Roadmap of software evolution, equations and differences with PL care, research topics	



in ot evolution
2. Introduction to cloning, cloning types, cloning sources, cloning evolution, cloning management, cloning detection, cloning presentations, cloning algorithms, and the latest developments on cloning.
3. Introduction to software repositories, analysis of software repositories, release history, analysis software evolution, tools to help software repositories.
4. Analysis algorithms software repository.
5. Introduction to prediction of errors, causes of defect-prones in PL, PL metrics, error prediction techniques, code churn, issues that are still open and relevant to be discussed, threats to validity.
6. Object-oriented reengineering: refactoring.
7. Software reengineering success and failure factors.
8. Current research topics such as Software re-engineering patterns.
9. Exploration and development of research topics.
PREREQUISITE
-
REFERENCES
1. Tom Mens dan Serge Demeyer, <i>Software Evolution</i> , Springer-Verlag, Berlin, 2008.
2. Nazim H. Madhavi, Juan Fernandez-Ramil, dan Dewayne Perry, <i>Software Evolution and Feedback: Theory and Practice</i> , John Wiley & Sons, England, 2006.
3. M. M. Lehman, <i>Program Evolution</i> , Academic Press, London, 1985.
4. M. M. Lehman, <i>The Programming Process</i> , IBM Res. Rep. RC 2722, IBM Research Centre, Yorktown Heights, NY 10594, Sept. 1969.
5. M. M. Lehman & L. A. Belady, <i>Program Evolution – processes of software change</i> , Academic Press, London, 1985.

COURSES	Course Name : Topics In Software Project Management
	Course Code : IF185972
	Credit : 3 sks
	Semester : 2
Course Description	
Topics in Software Project Management include deepening theories related to software project management, identification and analysis of problems that exist in software project management and methods of solving them. Through this course, students are invited to study and understand the latest papers in the field of software project management. Lectures are delivered in class in the form of lectures, discussions and presentations. Students are also conditioned to be able to learn independently, understand current papers about project management, identify new problems and define solutions based on the methodology studied. Learning is also carried out in the laboratory and in the field to experiment with the solutions offered. Students are invited to write problem identification, proposed solutions and experimental results in a paper that can be published in seminars and journals.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Mastering theory and application theory in software design and development with standard and scientific methods of planning, requirements engineering, designing, implementing, testing, and launching, to produce software products that meet various technical and managerial quality parameters, and are efficient in software development.	
2. Able to model, analyze and develop software using the principles of software engineering processes to produce software that meets both technical and managerial quality.	
COURSE LEARNING OUTCOMES	
1. Students know and understand the activities in the software project management life cycle	
2. Students know the latest research topics on software project management	



3. Students are able to identify current problems in software project management topics.
4. Students are able to identify and propose solutions to problems in the previous points in the form of scientific writing
5. Students are able to present and present problems and solutions proposed in scientific forums in class
6. Students are able to conduct experiments based on the methodology produced and are able to present the results obtained in scientific writing
7. Students are able to write scientific papers to present problems, solutions, experiments, results and discussion of the results of topics that have been selected and studied.

SUBJECT

1. Initiation and definition of software project scope: determination and negotiation of requirements, feasibility analysis, process for reviewing and revising requirements
2. Software project planning; process planning, determining deliverables, effort, schedule and cost estimation, resource allocation, risk management, quality management, planning management
3. Software project enactment: implementation of plans, management of PL acquisition and supplier contracts, implementation of measurement processes, process monitoring, process control, reporting
4. Evaluation and review of Software projects; determine satisfaction of needs, review and evaluate performance
5. Completion of software projects; determine closure, project closure activities
6. Software engineering measurements; establish and sustain measurement commitment, plan the measurement process, assess the measurement process, evaluate measurement
7. Tool to assist software project management

PREREQUISITE

-

REFERENCES

1. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK(R) Guide), 5th ed., Project Management Institute, 2013.
2. Project Management Institute and IEEE Computer Society, Software Extension to the PMBOK® Guide Fifth Edition, Project Management Institute, 2013.
3. R.E. Fairley, Managing and Leading Software Projects, Wiley-IEEE Computer Society Press, 2009.
4. Sommerville, Software Engineering, 9th ed., Addison-Wesley, 2011.
5. B. Boehm and R. Turner, Balancing Agility and Discipline: A Guide for the Perplexed, Addison-Wesley, 2003.

COURSES	Course Name : Topics in Requirements Engineering
	Course Code : IF185973
	Credit : 3
	Semester : 2
COURSES DESCRIPTION	
Requirements engineering studies related aspects of approaches, methods, frameworks, and requirements engineering tools that can solve certain real problems.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Mastering theory and application theory in software design and development with standard and scientific methods of planning, requirements engineering, designing, implementing, testing, and launching, to produce software products that meet various technical and managerial quality parameters, and are efficient in software development. 2. Able to model, analyze and develop software using the principles of software engineering	



processes to produce software that meets both technical and managerial quality.
COURSE LEARNING OUTCOMES
Students are able to develop approaches, methods, frameworks, and needs engineering tools that can solve certain real problems.
SUBJECT
Dalam Matakuliah ini mahasiswa akan mempelajari SUBJECT-SUBJECT sebagai berikut: 1. CONCEPTS AND PRINCIPLES OF ENGINEERING NEEDS OF SOFTWARE: the concept of requirements engineering, functional / non-functional requirements, types of stakeholders, 2. ELICITATION: methods, approaches, frameworks, and needs elicitation technology, as well as current issues and research 3. MODELING: methods, models, assistive tools and technology for modeling needs, as well as current issues and research 4. SPECIFICATIONS: methods, models, assistive tools, and technology requirements specification, as well as current issues and research 5. VERIFICATION AND VALIDATION OF REQUIREMENTS SPECIFICATION: methods, models, assistive tools, and verification and validation technologies for needs, as well as current issues and research.
PREREQUISITE
-
REFERENCES
1. Daniel Siahaan, "Rekayasa Kebutuhan, "Penerbit Andi, 2012. 2. Artikel dari Jurnal dan Konferensi di bidang Rekayasa Kebutuhan Perangkat Lunak 3. Materi dan bahan bacaan yang diberikan di kelas.

COURSES	Course Name : Topics In Software Quality Assurance
	Course Code : IF185974
	Credit : 3 sks
	Semester : 2
COURSES DESCRIPTION	
The purpose of this course is to provide knowledge to students about the concept of quality, characteristics, and value of software, as well as its application to software that is being developed or maintained. The important concept is that the software requirement will determine the quality attributes of the software. Software requirements determine the quality measurement method and acceptance criteria to conclude the predetermined level of software quality level attainment.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Mastering theory and application theory in software design and development with standard and scientific methods of planning, requirements engineering, designing, implementing, testing, and launching, to produce software products that meet various technical and managerial quality parameters, and are efficient in software development. 2. Able to model, analyze and develop software using the principles of software engineering processes to produce software that meets both technical and managerial quality.	
COURSE LEARNING OUTCOMES	
1. Be able to find and identify current issues in at least one of the areas of software quality management: testing, standards, metrics, error estimation, etc. 2. Able to find and identify problems that still exist / arise and are still developing in one of these areas. 3. Able to formulate core problems in one of the selected domains, and write hypotheses to describe the proposed solutions. 4. Able to formulate a solution description in a conceptual framework that represents a	



complete range of solutions.
5. Able to describe the conceptual framework into components / subsystems that can be implemented.
6. Able to implement components / subsystems into a system that can be tested and measured the results / correctness, as a preliminary experimental tool.
7. Able to determine the dataset that will be used in the initial experimental process in the solution system.
8. Able to perform initial testing to support predetermined hypotheses, using a prepared dataset.
9. Able to analyze initial test results.
10. Able to discuss the results of the analysis of the initial test in the form of critical discussions that lead to initial conclusions..
11. Able to formulate and conclude the results of preliminary experiments on proposed solutions in the form of scientific articles.
12. Able to publish scientific articles (hypothetical articles / position papers) in at least national conferences or national journals.
SUBJECT
4. The basics of quality software ○ Software ethics and culture ○ Value and cost of software quality ○ Model characteristics and software quality ○ Software quality improvement ○ Aspects related to software security (safety)
5. Software quality management process ○ Quality assurance ○ Verification and validation ○ Audits and reviews
6. Practical consideration of software quality ○ Software quality requirements ○ Characterization of defects (defects) ○ SQM technique (software quality management) ○ Measurement of software quality
8. Tool to assist software quality
9. Measurement standards and software quality
6. Software quality metrics
7. Software quality costs and cost estimates
8. Software quality enhancements
9. Other topics relevant to software quality assurance.
PREREQUISITE
Minimum score of C in the Software Engineering course
REFERENCES
1. S. Naik and P. Tripathy, Software Testing and Quality Assurance: Theory and Practice, Wiley-Spektrum, 2008.
2. S.H. Kan, Metrics and Models in Software Quality Engineering, 2nd ed., Addison-Wesley, 2002.
3. D. Galin, Software Quality Assurance: From Theory to Implementation, Pearson Education Limited, 2004.
4. J.W. Moore, <i>The Road Map to Software Engineering: A Standards-Based Guide</i> , Wiley-IEEE Computer Society Press, 2006.
5. <i>IEEE Std. 12207-2008 (a.k.a. ISO/IEC 12207:2008) Standard for Systems and Software Engineering—Software Life Cycle Processes</i> , IEEE, 2008.
6. <i>ISO 9000:2005 Quality Management Systems—Fundamentals and Vocabulary</i> , ISO, 2005.
7. <i>IEEE Std. 1012-2012 Standard for System and Software Verification and Validation</i> , IEEE,



2012.
8. <i>IEEE Std. 1028-2008, Software Reviews and Audits</i> , IEEE, 2008.
9. Artikel-artikel tentang Kualitas Perangkat Lunak terbaru pada IEEE, ACM, Elsevier, dll.

COURSES	Course Name : Thesis - Proposal
	Course Code : IF185301
	Credit : 4
	Semester : 3
COURSES DESCRIPTION	
This course aims to provide students in writing research proposal and thesis development. It consists of knowledge in research topic to conduct, research methodology and development, experiment design and implementation using relevant tools.	
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE	
1. Able to develop logical, critical, systematic, and creative thinking through scientific research, the creation of designs or works of art in the field of science and technology that pay attention to and apply the values of the humanities in accordance with their fields of expertise, compile scientific conceptions and study results based on rules, procedures, and scientific ethics in the form of a thesis or other equivalent, and uploaded on the college website, as well as papers that have been published in accredited scientific journals or accepted in international journals 2. Able to carry out academic validation or studies according to their field of expertise in solving problems in the relevant community or industry through the development of their knowledge and expertise; 3. Able to identify the scientific field that becomes the object of his research and position it on a research map developed through an interdisciplinary or multidisciplinary approach; 4. Able to make decisions in the context of solving problems in the development of science and technology that pay attention to and apply humanities values based on analytical or experimental studies of information and data; 5. Able to document, store, secure, and recover research data in order to ensure validity and prevent plagiarism;	
COURSE LEARNING OUTCOMES	
Students are able to present a thesis proposal that has been made according to the related research topic.	
SUBJECT	
Thesis proposal includes making a thesis proposal and presenting it in front of the examiner team and other students.	
PREREQUISITE	
-	
REFERENCES	

COURSES	Course Name : Thesis - Scientific Publication
	Course Code : IF185302
	Credit : 2
	Semester : 3
COURSES DESCRIPTION	
This course aims to provide students knowledge and skills in writing and publishing article from their research and development at international conference or national accredited	



journal or international journal.
GRADUATE LEARNING OUTCOMES CHARGED IN THE COURSE
1. Able to develop logical, critical, systematic, and creative thinking through scientific research, creation of designs or works of art in the field of science and technology that pay attention to and apply the values of the humanities in accordance with their areas of expertise, compile scientific conceptions and study results based on rules, procedures , and scientific ethics in the form of a thesis, and uploaded on the college website, as well as papers that have been published in accredited scientific journals or accepted in international journals; 2. Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and communicate them through the media to the academic community and the wider community; 3. Able to document, store, secure, and recover research data in order to ensure validity and prevent plagiarism.
COURSE LEARNING OUTCOMES
Students are able to make scientific articles according to related research topics and publish in accredited national journals or international journals.
SUBJECT
Making scientific articles according to related research topics and according to the format of the articles in the intended scientific journals.
PREREQUISITE
-
REFERENCES

COURSES	Course Name : Thesis - Final Session
	Course Code : IF185401
	Credit : 6
	Semester : 4
COURSES DESCRIPTION	
This course aims to provide students in conducting research, writing research report, and oral presentation in front of board of examiners.	
SUPPORTED STUDY PROGRAM LEARNING OUTCOMES	
1. Able to develop logical, critical, systematic and creative thinking through scientific research, the creation of designs or works of art in the field of science and technology that pay attention to and apply the values of the humanities in accordance with their fields of expertise, compile scientific conceptions and study results based on rules, procedures , and scientific ethics in the form of a thesis or other equivalent, and uploaded on the college website, as well as papers that have been published in accredited scientific journals or accepted in international journals; 2. Able to carry out academic validation or studies according to their field of expertise in solving problems in the relevant community or industry through the development of their knowledge and expertise; 3. Be able to identify the scientific field that is the object of research and position it on a research map developed through an interdisciplinary or multidisciplinary approach; 4. Able to make decisions in the context of solving problems in the development of science and technology that pay attention to and apply humanities values based on analytical or experimental studies of information and data; 5. Able to document, store, secure, and retrieve research data in order to ensure validity and prevent plagiarism.	
COURSE LEARNING OUTCOMES	



Students are able to develop a thesis, write it in a thesis report and publish scientific papers at the national and international levels.
SUBJECT
Develop a thesis according to research methodology and write a thesis report and publish it as a scientific paper at the national and international levels.
PREREQUISITE
-
REFERENCES

10. Learning Management (*Pengelolaan Pembelajaran*)

10.1. Teaching Methodology (*Metodologi Pengajaran*)

To fulfill students' requirements for up-to-date knowledge, skill, and expertise in information technology, the MIP design a flexible and dynamic academic curriculum. The courses in the curriculum are updated to catch up with the development of knowledge and technology. The curriculum covers both hard skills and soft skills integrated into every course by facilitating active student participation with laboratory work, individual assignments, and team-based research. The details of the teaching methodologies are:

1. Teaching and learning process based on Student Centre Learning (SCL).

In SCL, a student becomes a subject that dynamically and interactively learns the courses, such as working on a case study from real-world or company problems. The MIP provides supportive learning media in classes and research laboratories.

2. Participation or publication in international conferences and journals

In order to improve student's creativity and research skill, the MIP encourages students to participate in conferences. Lecturers supervise students to submit their paper in conference or journal to enhance their research knowledge and experiences.

3. Weekly laboratory meetings

Periodical meetings discuss recent topics in technology, research plan, student wellbeings, etc. The thesis talk assists students in developing analytical skills, communication skills, problem-solving skills, or practices before the official thesis talk. The meeting is attended by lecturers, research teams, or students who work on research projects for their master thesis. The thesis progress can be monitored using a web-based information system (<http://montes.if.its.ac.id>) accessible by students and lecturers. The website facilitates lecturers to monitor a thesis progress and schedule.

4. Utilize references in the library

Textbooks, e-books, journals, thesis, and other multimedia resources are available. The MIP library website (<http://rbtc.if.its.ac.id>) links the students to useful references. Students can also access the university library system as well at <http://digilib.its.ac.id>.

5. E-learning system for self-learning

Students can learn individually or in a group before or after class by using the e-learning system (myITSclassroom). The e-learning system provides lecture materials, an announcement for lectures, class discussions, assignments, and assessments.

6. Information Technology related seminar/ conference/ forum

Lecturers and students are involved in research at the local, national, and international levels. An annual international conference (International Conference on Information & Communication Technology and Systems - ICTS) held by the Department of Informatics acts



as a forum for information dissemination and technology development communication. Jurnal Teknologi Informasi (JUTI) is a journal managed by the DIF that publishes papers from internal and external researchers. The conference and journal catalyze the lecturer's and students' partnerships with many institutions (Attachment 2.13: ICTS description). The MIP also carries out academic forums which are held occasionally based on the recent trend in information technology.

The MIP construct teaching and learning methodology based on scientific studies and stakeholder inputs focusing on the student's need. According to those considerations, the teaching and learning strategy emphasizes three aspects: teaching and learning process, student's identity, and knowledge implementation. The first aspect is teaching, and the learning process should enable students to acquire and develop knowledge, skill, and expertise in Information Technology. The second aspect is the strategy to shape students' identity, such as integrity, leadership, teamwork, and communication skills. The last aspect orients students' ability to transform ideas into research paper to solve any correlated problems.

10.2.Exam, System, Concept, and Organization (*Ujian, Sistem, Konsep, dan Organisasi*)

The learning assessment standards are designed based on the National Higher Education Standards. The assessment principles are based on educational, authentic, objective, and transparent principles in an integrated manner. The assessments aim to motivate students to improve their way of study to achieve learning outcomes. Therefore, a continuous learning process that reflects the student's ability during learning is necessary. As stated in the Quality Standard Guidelines for Postgraduate Program 2020 ITS has 14 criteria to fulfill the quality standards for the learning and assessment processes:

1. The learning process must be student-centered
2. The learning process in each courses must be implemented in accordance with the learning plan
3. The learning process related to research must be carried out with reference to research standards
4. The learning process must be able to grow and provide opportunities for students to develop their potentials and abilities during and after the study period
5. The learning process outside the Study Program and / or ITS will be carried out based on the cooperation agreement between ITS and other universities or other related institutions, under the guidance of ITS lecturers
6. Students must obtain clear information about the objectives of each learning process, the method of assessment, and the level of success achieved.
7. The applied learning method must be efficient and effective in developing academic interaction between lecturers, students, and learning resource, supported by educational staff services
8. The applied assessment must include: educational, authentic, objective, accountable and transparent principles, techniques and instruments, and clear procedures
9. The lesson plan must be well prepared and implemented and controlled by adequate monitoring and evaluation systems
10. Students must have clear information about learning facilities, scholarship opportunities,

research activities and other academic activities

11. Learning materials must be relevant, current, lead to a clear order of competencies and abilities, and can motivate and develop student innovation and creativity
12. Complete written guidelines on the procedures and processes of research guidance, preparation and thesis, dissertation, and other works, must be provided and can be easily accessed by students
13. Facilities and opportunities must be provided for students to disseminate their research results and other scientific works
14. Records of learning progress, students who are able to study and student learning, must be submitted periodically to learn and study in the process of achieving CPL

The phases of the assessment plan and evaluation is shown in Figure 1. Each course's learning plan clearly states modes and time of evaluation and each assessment component's marking scheme. The number of assessment is at least four times (based on the Academic Rules 2019) that usually cover:

- The affective score aims to encourage students to raise questions and join class discussions actively
- The individual score aims to check students' understanding of the subjects in a course and to promote self-study
- The group-work and presentation score aim to develop students' communication skills, which are very helpful for their future real-life jobs
- The written score aims to observe the ability of students in solving problems

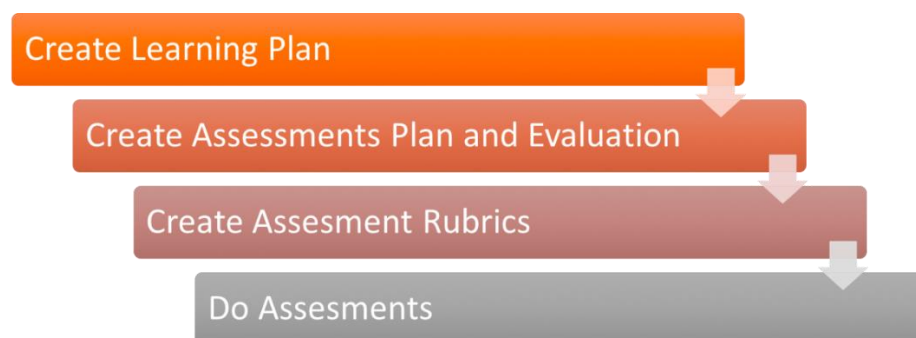


Figure 3. 1. Phase of Assessment Plan and Evaluation

The learning assessment cycle is carried out continuously according to each course's learning plan to support the course learning outcomes (Figure 2). Assessment results should be informed to students for their feedback along the route of the semester. Lecturers can give remedies for students that have not passed course learning outcomes. There are several types of learning assessments namely exams, reports, presentations, paper review, thesis, etc. Each assessment uses a rubric containing criterias that must be met by students. The criteria in this rubric are given to students at the beginning of the semester so the students can see the learning targets they want to achieve. By using this system, student learning progress can be measured accurately and transparently.

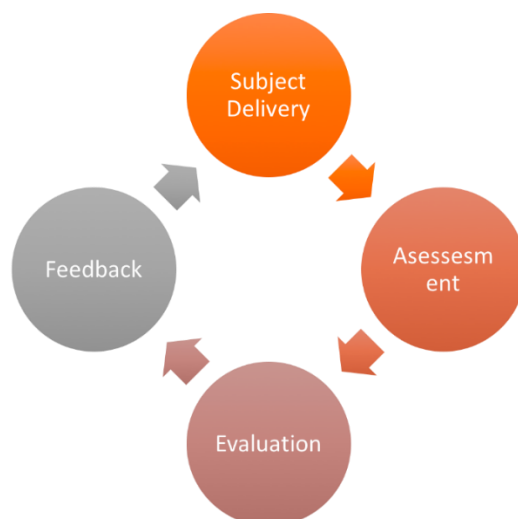


Figure 3. 2. The Cycle of Learning Assessment in a Subject

Table 18 Sample of Assessments Plan and Evaluation for Computational Intelligence Course

Week (1)	Sub CLO (2)	Assessments (3)	Weight (%) (4)
3	Students able to analyze data, data transformation, and feature extraction	ASSESSMENT 1: Implement the data tranformation method on a dataset and analyze the experiment results.	10%
7	Students able to analyze the classification methods and its use in an application	ASSESSMENT 2: Implement the Fuzzy Inference System and Decision Tree methods on a dataset and analyze the experiment results.	10%
10	Students able to analyze the classification methods and its use in an application	ASSESSMENT 3: Implement the classification methods on a dataset and analyze the experiment results.	15%
13	Students able to analyze the clustering method and its use in an application	ASSESSMENT 4: Review a paper related to the classification or clustering problem and make presentation	25%
16	Students able to design the optimization method and its use in classification and clustering problems.	ASSESSMENT 5: Completing a project, namely, a real problem raised as a topic using the machine learning stages and evaluating the results of its performance.	40%
Total			100%

Table 19 Sample of Rubric Assessments for Computational Intelligence Course

Rubric Assessment 1 and 3

No	Aspect	Weight	Score	Notes
1	Functionality	30%		
2	Method	30%		
3	Analysis	15%		
4	Presentation	20%		
5	Submission punctuality	5%		
	Total Weight Score	100%		



Rubric Assessment 1 and 3

No	Aspect	Weight	Score	Notes
----	--------	--------	-------	-------

Rubric Assessment 2

No	Aspects	Weight	Score	Notes
1	Answer accuracy no 1	45%		
2	Answer accuracy no 2	50%		
3	Submission punctuality	5%		
	Total Weight Score	100%		

Rubric Assessment 4

No	Aspect	Weight	Score	Notes
1	Complexity	30%		
2	Presentation	30%		
3	Quality of Journal	15%		
4	Opinion	20%		
5	Submission punctuality	5%		
	Total Weight Score	100%		

Rubric Assessment 5

No	Aspect	Weight	Score	Notes
1	Functionality	25%		
2	Method	25%		
3	Analysis	15%		
4	Presentation	20%		
5	Submission punctuality	5%		
6	Teamwork	10%		
	Total Weight Score	100%		

Lecturers use the university's academic website to store the student assessment scores. Students can see the assessment results using the same website with the student role once lecturers submit the scores. The students will receive their grades for each course ranging from A-E as in Table 2.2, according to ITS Academic Rule 2019.

The curriculum has arranged all courses spread in four semesters with 6 or 12 credit points on each semester. Student evaluations will be done at the end of 2nd and maximum on 8th semester. According to ITS Academic Rule 2019 students are allowed to continue their studies, if:

- The first evaluation is at the end of Semester 2. Students must pass 12 of the 36 SKS scheduled with GPA ≥ 2.5 and minimum grade C in all courses. The students will given a trial status when they can not fulfill the requirement. They can continue their studies when they the GPA ≥ 2.5 requirement in the third semester.
- The second evaluation is at the end of Semester 8. Students are to graduate when:
 - The students pass the minimum 36 SKS requirement with GPA ≥ 3.0 with maximum 20% courses with grade C. Students can complete their study in minimum of 3 semester and maximum of 8 semesters.



- The students must also submit an article to be published in an accredited national journal or is accepted in an international journal or a reputable international conference.

In addition, ITS requires students to have a minimum 477 TOEFL score or other equivalent standards. All of those rules are listed in ITS Academic Rules 2019.

The Thesis for magister students of the Department of Informatics is equal to a 12 SKS divide into three courses i.e. Thesis - Proposal (3 SKS), Thesis - Scientific Publication (3 SKS), and Thesis – Final Defense (6 SKS). There are three graduation predicates, i.e. Cumlaude, Very Good, and Good. The graduation predicate is determined based on the GPA and the length of study (Table 4). Students with the “Cumlaude” predicate receive a certificate given in the graduation ceremony.

Table 20 Graduation Predicate Rule

Predicate	GPA	Length of Study	Description
Cumlaude	≥ 3.75	≤ 2 years	minimum B grade for every course
Very Good	> 3.75	> 2 years	
	$3.51 \leq \text{GPA} \leq 3.75$	-	
Good	$3.00 \leq \text{GPA} \leq 3.50$	-	

Magister's Thesis

The thesis course trains students to analyze, identify, summarize, and apply all of their learning experiences to solve problems in the informatics area. The thesis gives the students an experience to think systematically, logically, creatively, critically, and find original ideas to contribute to technology development. The details of the criteria are:

- a thesis must provide clarity of the object to be studied, the problem to be solved, the hypothesis to be proved, and a research question that remains unanswered.
- a thesis must define the object to be designed, the problem to be solved or the design idea to be achieved, the design methods to be used to solve the problem or to achieve ideas, and the advantages and disadvantages of the proposed design.

Students must have completed 12 SKS to take the thesis proposal course (scheduled in Semester 3). The outcome of this course is a complete proposal to be submitted to one of the research groups. Students submit their proposals to a web-based monitoring system (MONTES) to track their thesis status and progress. The MONTES website (Figure 1. Web montes) can be found on this link <http://montes.if.its.ac.id/>.



Sistem Manajemen dan Monitoring Tesis Pasca Sarjana Teknik Informatika

lina

Proposal

Halaman ini digunakan untuk pengaturan dan menampilkan daftar proposal tesis mahasiswa

Proposal Kolom Tambah Hapus

Periode: Semua Status Proposal: Semua

Tanggal Ujian: Clear

10 records per page Search:

id	RMK	NRP	Mahasiswa	Periode	Judul	Tanggal Submit	Status
☐	KCV	05111850010031	SYADZA ANGGRAINI	2019 Genap	PENGUKURAN KEMIRIPAN BERBASIS LEKSIKAL DAN SEMANTIK UNTUK PERANGKINGAN DOKUMEN BERBAHASA ARAB	2020-04-03 11:32:26	Disetujui
☐	KCV	05111950010028	SYAVIRA TIARA ZULKARNAIN	2019 Genap	Representasi Fitur Menggunakan Multi-scale Block Modified Local Ternary Pattern pada Pengenalan Wajah Berbasis Video	2020-05-04 09:43:14	Disetujui
☐	KCV	05111950010004	ADENUAR PURNOMO	2019 Genap	KLASIFIKASI KEJANG EPILEPSI MULTI-KELAS BERBASIS ELECTROENCEPHALOGRAPH MENGUNAKAN MODIFIED BATCH NORMALIZATION NEURAL NETWORK	2020-05-04 09:43:17	Disetujui
☐	KCV	05111950010032	ANA ALIMATUS	2019 Genap	PEMBANGKITAN KATA MENGGUNAKAN METODE DEEP LEARNING DENGAN PERLUASAN REPRESENTASI VEKTOR KATA BERBASIS TOPIK PADA DATASET REVIEW	2020-05-04	Disetujui

(a)

Sistem Manajemen dan Monitoring Tesis Pasca Sarjana Teknik Informatika

lina

Ujian Tesis

Halaman ini digunakan untuk menampilkan dan mengatur ujian tesis mahasiswa

Ujian Tesis Kolom Tambah Hapus

10 records per page Search:

id	NRP	Nama	Periode	Judul	Status
☐	05111950010020	MUTIA RAHMI DEWI	2019 Genap	Ekstraksi Aspect of What dari Berita Daring dengan Word Embedding untuk Elistasi Kebutuhan Perangkat Lunak	Siap Ujian
☐	05111950010022	NAFINGATUN NGALIAH	2019 Genap	EKSTRAKSI USER STORY DARI BERITA DARING MENGGUNAKAN METODE FEATURE-BASED DAN MAXIMUM ENTROPY UNTUK ELISITASI KEBUTUHAN PERANGKAT LUNAK	Siap Ujian
☐	05111950015005	DINI YUNIASRI	2019 Genap	Analisis Keterkaitan antara CK Metriks dan Modularitas pada Perangkat Lunak Berbasis Objek	Siap Ujian
☐	05111950010009	ALQIS RAUSANFITA	2019 Genap	Ekstraksi Kebutuhan Pengguna Pada Atribut Kualitas Perangkat Lunak Menggunakan Metode Latent Dirichlet Allocation dan Inverse Document Frequency	Siap Ujian
☐	05111950010024	VESSA RIZKY OKTAVIA	2019 Genap	PENILAIAN OTOMATIS JAWABAN SOAL CERITA MATEMATIKA UNTUK IDENTIFIKASI KOMPETENSI BERHITUNG SISWA SEKOLAH DASAR DI INDONESIA	Siap Ujian

(b)

Sistem Manajemen dan Monitoring Tesis Pasca Sarjana Teknik Informatika

lina

Tesis

Status Tesis: Semua

10 records per page Search:

NRP	Mahasiswa	Jenjang	Judul	Pembimbing 1	Pembimbing 2	Status	Lama Pengerjaan
05111950015005	DINI YUNIASRI		Analisis Keterkaitan antara CK Metriks dan Modularitas pada Perangkat Lunak Berbasis Objek	Dr. Ir. Siti Rochimah, M.T.	Dr. Agus Budi Raharjo, S.Kom., M.Kom.	Pengerjaan	22 Minggu
05111950010033	HIDAYATUL MUNAWAROH		Pengukuran Kekeragaman Semantik Menggunakan Pemrosesan Bahasa Alami dan Kekeragaman Struktural Menggunakan Graph Edit Distance-Greedy pada Statechart Diagram	Daniel Oranova Siahaan, S.Kom., M.Sc., PD.Eng.		Pengerjaan	22 Minggu
05111950010028	SYAVIRA TIARA ZULKARNAIN		Representasi Fitur Menggunakan Multi-scale Block Modified Local Ternary Pattern pada Pengenalan Wajah Berbasis Video	Dr. Eng. Nanik Sucati, S.Kom., M.Kom.		Pengerjaan	22 Minggu
05111950010024	VESSA RIZKY OKTAVIA		PENILAIAN OTOMATIS JAWABAN SOAL CERITA MATEMATIKA UNTUK IDENTIFIKASI KOMPETENSI BERHITUNG SISWA SEKOLAH DASAR DI INDONESIA	Dr. Umi Laili Yuhana, S.Kom., M.Sc.	Dr. Eng. Chastine Fatichah, S.Kom., M.Kom.	Pengerjaan	22 Minggu

(c)



Sistem Manajemen dan Monitoring Tesis Pasca Sarjana Teknik Informatika

Publikasi

Halaman ini digunakan untuk manajemen publikasi mahasiswa

Tipe Publikasi : Semua

10 records per page

Search:

	NRP	Nama	Pembimbing 1	Pembimbing 2	Judul Tesis	Tipe Publikasi	Judul Seminar / Nama Jurnal	Tanggal Seminar / Nomor Jurnal
☐	5116201033	Yutika Amelia Effendi	Prof. Drs. Ec. Ir. Rianarto Sarno, M. Sc., Ph. D.		ALGORITMA TIME-BASED ALPHA MINER UNTUK MEMODELKAN PROSES BISNIS DAN PENGOPTIMASIAN MENGGUNAKAN SISTEM MANUPAKTUR FLEKSIBEL DI TERMINAL PETIKEMAS	Jurnal	Hierarchy Process Mining from Multi-Source Logs/ TELKOMNIKA	Vol 15, No 4, December 2017
☐	5116201045	Kelly Rossa Sungkono	Prof. Drs. Ec. Ir. Rianarto Sarno, M. Sc., Ph. D.		Perbaikan Proses Bisnis yang Terpotong dalam Kasus yang Mengandung Aktivitas Tidak Terlihat dan Pilihan Tidak Bebas pada Terminal Petikemas	Jurnal	International Journal of Innovative Computing, Information and Control (IJICIC)	14 (4)
☐	5116201006	Hendro Eko Prabowo	Tohari Ahmad, S.Kom., MIT.		Peningkatan Kinerja Prediction Error Expansion dalam Data Hiding dengan Mereduksi Error Expansion dan	Jurnal	Journal of Communications	-

(d)

Figure 3. 3. The interface of MONTES (a) login page (b) proposal thesis approval page (c) thesis defense approval page (c) thesis monitoring report page (d) thesis publication page

When writing a thesis proposal, a student chooses his/her supervisor(s) and discusses the thesis topic, scope, and method. The principal supervisor must be a permanent lecturer of the DIF that suits the student's research interest, while the co-supervisor can be a permanent or non-permanent lecturer. The quality standard of thesis supervisors is stated in the Quality Standard Guideline for postgraduate program. The compulsory requirement for a main thesis supervisor is to have a doctoral education with a minimum academic position as Lector.

A student cannot begin working on the thesis (e.g., collecting, data, and formal analysis of data) until the student passes an proposal oral defense. The construction of a thesis proposal must include a survey of the research literature, a statement of research objective(s), a detailed description of the methods, and the significance of the proposed thesis. The student prepares official paper work to be signed by the supervisor(s). The supervisor(s) examines and approves the proposal before submission. A thesis coordinator manages and summarizes the submission on MONTES then reports to the head of the research group. The head of the research group manages the schedule and the examiners for the oral defense of the proposal thesis submission. The examiners consist of supervisors and three lecturers who have similar research fields. They decides the outcome of a thesis proposal where a proposal is approved, revised, or disapproved depending on the proposal's quality and the relevance to the research group. In the revision case, the student is required to revise and resubmit it to MONTES. Then, the same process applies to the initial one.

Once the thesis proposal is approved, the student may begin his/her magister thesis. Students must have regular meetings (at least eight times) with his/her supervisor(s) to discuss the direction of the work, any concerning issues, a summary of key results, and experiment designs. A thesis's duration is up to one year after the examiner's date of approval. Otherwise, the student is required to propose a new topic.

The supervisors certify a thesis completion based on the achievement of the progress to the initial planning and possibly some changes during the course. Once the supervisors issue the certification, a student must prepare the following documents to the thesis coordinator for an oral defense to be scheduled:



- A thesis book
- A thesis completion certificate signed by the supervisor(s)
- TOEFL certificate
- The accepted letter and article for thesis publication

Thesis oral defenses are scheduled at most 4 weeks before the graduation judiciary. The head of the research group are in charge of scheduling the oral defenses. An oral defense committee is attended by the supervisor(s) and three examiners (a lead examiner and a member examiner). The quality standard of thesis examiners has set out in the Quality Standard Guideline for postgraduate program.

An oral defense session will take place for 60 minutes, including a synopsis of the thesis presentation and the question and answer session. The presentation intends to help the committee assess the students' understanding of his project and other research-related aspects. The committee engage the student defenses sessions by asking questions based on what the students present and related thesis documents. A certificate of thesis completion is signed when a student passes the oral defense. However, if there are some revisions, the signature will be postponed until the revisions are completed.

Thesis grades range from 56 to 100 and converted to an alphabetical grading scheme (Table 2.2). The following 4 (four) components determine a thesis grade:

- thesis materials: the design, analysis, experiment, and demo application;
- level of understanding: the accuracy in answering questions;
- presentation skills: communication skill, time control, and clarity of the presentation; and
- documentations: mainly concerns the writing skills for the thesis report, publication, etc.