STUDY PROGRAM CURRICULUM
MULTIMEDIA NUSANTARA
UNIVERSITY

Drafting Team

Rector of Multimedia Nusantara University
Vice Rector I for Academic Affairs
Head of the Study Program
Deputy Head of the Study Program
Academic Information Bureau

CURRICULUM OF THE INFORMATICS STUDY PROGRAM

A. Profile

In part, describe profile related to the Study Program Informatics Faculty of Engineering and Informatics Multimedia Nusantara University.

Specification Program	:	Undergraduate program
Program type	:	Informatics
program title	:	Bachelor in Computer Science (Bachelor computer)
Department	:	Department of Informatics
Faculty	:	Faculty of Engineering and Informatics
University	:	Multimedia Nusantara University
Degree titles	:	Bachelor in Computer Science (B.Cs); Bachelor Computer (S.Kom)
awarding institution	:	Universitas Multimedia Nusantara
teaching institution	:	Universitas Multimedia Nusantara
class	:	Local/regular classes
		joint degrees
Language of study	:	Indonesian
		English
Duration of the Program	:	48 months (4 years)
Credits	:	Minimum 146 credits
IQF (IQF level)	:	Level 6
Accreditation bodies	:	BAN-PT Predicate B (2020-2025)
QAA benchmarks	:	BAN – PT
		ASIIN – EQANIE FRAMEWORK

As for Vision and Mission from Study Program is as following :

VISION :

Becoming a leading Informatics Study Program that produces graduates with international insight who are competent in the field of computer science, have an entrepreneurial spirit and have a noble character.

MISSION :

1. Organizing learning with the best technology and curriculum and supported by professional teaching staff
2. Carry out research activities in the field of informatics science and technology
3. Carry out community service activities based on information technology and science in the context of practicing informatics science and technology

Based on Vision and Mission of the study program, then Program Objectives are also formulated from the Informatics Study Program, namely:

1. Produce graduates who are competent in the field of intelligent systems, software development, computer systems and networks, and use their expertise to build and develop systems based on informatics science
2. Produce graduates who understand the development, engineering and construction of systems in the field of intelligent systems, software development, systems and networks security based on professional ethics imposed in informatics science
3. Produce graduates who carry out lifelong learning and innovating solutions with technopreneur concepts in the field of informatics science which then continue to be applied when graduates work in national and global, conduct research,

community service in order to face the global era of industry 4.0 .

B. Career Prospects and Opportunities

Graduates from Informatics Study Program accepted among business as well as industry as power expert in the field knowledge computers and technology quality information.

Tracer study, tracking of alumni shows that about 90% of graduate of get work not more from three month after graduation.

A number of positions occupied by graduates of the study program is as following:

1. Software developer/engineer
2. Web Developers/engineers
3. Mobile Application developer/engineer
4. Administrator databases
5. system analyst
6. Network administrators/engineers
7. Cyber security specialist / engineer
8. Technical support engineer
9. Used experience designer
10. Project manager in IT
11. Data Scientist
12. Cloud computing engineer
13. Artificial intelligence / machine learning engineer
14. IT Consultants
15. IT Trainer / Educator
16. Quality Assurance Tester
17. Business Analyst
18. Game developers / Programmers
19. Full Stack Developer/Engineer
20. DevOps Engineer

C.Graduate Profile

The Graduate Profile is a benchmark in determining competency standards for the graduates of Informatics Study Program. Mastery of knowledge in the topic of Informatics is reflected in several profiles that have been formulated. Graduates of Informatics Study Program have four main profiles. The detailed explanation of each profile is described in Table 1.

Table 1. Graduate Profile of Informatics Study Program

#	ProfileName	Description
1	Developer Software	Become a software developer who is able to design the user interface and application architecture, develop programs including the field of artificial intelligence and cybersecurity, conduct testing, monitoring, and evaluation, analyze the behavior of the programs and perform maintenance, as well as to work in teams for complex projects.
2	System Administrator	Become a system administrator who is able to manage specific applications or software in a company, including computer systems, database management systems, security systems, and intranet systems.
3	Technopreneur	Become a technopreneur who is able to create business concepts based on existing opportunities by taking advantage of the development of technology and knowledge in the field of Informatics
4	Researcher	Become a researcher who is able to conduct and contribute scientific research in the field of Informatics in accordance with applicable rules and ethics.

D. Expected Learning Outcomes

The ELOs have been simplified from ten to nine objectives based on the suggestions form the stakeholders and alumni, and the reviews from the curriculum team, as well as the Education Program updates. The graduate profiles for the Informatics Study Program have been updated into software developers, system administrators, technopreneurs and researchers.

The details of ELOs are shown in Table 2.

Table 2. ELOs of Informatics Study Program

Code	ELO
ELO-1	**Ethical and Religious Skills** Students can apply religious and divine values, ethics and morals in learning, and teamwork in the field of informatics studies
ELO-2	**Analytical Thinking** Students are able to master basic concepts and theories as well as applied concepts and are able to implement these relationships with an informatics scientific approach and utilize this knowledge to find solutions to problems related to the fields of intelligent systems, information security, game development and software development
ELO-3	**Communications Skills** Students can communicate effectively independently or in groups and are able to conduct measurable performance appraisals
ELO-4	**Professional Skills** Students have work skills and are able to collaborate in the field of informatics to be able to compete nationally and globally
ELO-5	**Technopreneur Skills** Students are able to combine technical skills and entrepreneurial concepts in meeting business demands and societal demands

Code	ELO
ELO-6	**Software Development Skills** Students are able to apply science informatics theoretically and technically in the form of system requirements gathering and analysis, design and implementation using programming languages in software development.
ELO-7	**System Administrator** Students are able to manage certain applications or software, including computer systems, database management systems, security systems and intranet systems
ELO-8	**Research Skills** Students are able to implement science informatics and compile scientific descriptions of research results
ELO-9	**Long life Learning** Students can improve their skills in informatics through lifelong learning

F . Distribution of Courses per Semester

First and second semester (first year students), each student required take all mandatory or compulsory courses. Each subsequent semester, total maximum Credits (SKS) that can be obtained taken a student determined by achievement student it on acquisition Previous Semester Achievement Index (IPS) (note : if the semester is odd so will see odd semester IPS acquisition before, or 2 previous semesters , and vice versa). Students who have performance good academic, can submit to Academic Advisor for more courses in a current semester. This can be done by students at the time implementation in Pre -KRS in the previous semester.

Curriculum in Informatics Study Program, is designed so that student can graduate foe a maximum 8 semester (4 years) or can go through for 7 semesters if they have a good GPA Index (acceleration path). The following is a list of regular path courses and examples of the Acceleration Path. The Acceleration path can also be discussed together with academic advisor for an other scenarios.

Regular Path

Semester 1

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF130	Programming Fundamentals	3	0	-	Compulsory	
2	IF120	Discreate mathematics	3	0	-	Compulsory	
3	IF121	Linear Algebra	3	0	-	Compulsory	
4	IF150	Digital system	3	0	-	Compulsory	

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
5	UM162	Pancasila	2	0	-	Compulsory	16
6	UM152	Religion	2	0	-	Compulsory	
7	UM163	Civics	2	0	-	Compulsory	16
8	UM122	English 1: Composition	2	0	-	Compulsory	
TOTAL CREDIT SEMESTER 1			**20**				

Semester 2

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF260	Operating System	2	1		Compulsory	
2	IF232	Algorithm & Data structure	3	1	IF130, IF121	Compulsory	
3	IF231	Introduction to Internet Technology	2	1		Compulsory	
4	MSC1003	Communication and Personal Relationships	2	0	IF150	Compulsory	
5	IF240	Calculus	4	0		Compulsory	
6	IF250	Computer Architecture and Organization	3	0		Compulsory	
7	UM223	English 2 : speaking	2	0	UM122	Compulsory	
TOTAL CREDIT SEMESTER 2			**21**				

Semester 3

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF350	Software Engineering and Project Management	3	0	-	Compulsory	
2	IF330	Web Programming	2	1	IF231	Compulsory	
3	IF331	Declarative Programming	3	0	IF232	Compulsory	
4	IF332	Language Theory and Automata	3	0	IF120	Compulsory	
5	IF351	Database System	3	0	IF120	Compulsory	1,2,5
6	IF360	Probabilistic and Statistics	3	0	IF120	Compulsory	
7	UM142	Indonesian	2	0	-	Compulsory	
TOTAL CREDIT SEMESTER 3			**20**				

Semester 4

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF433	Object Oriented Programming	2	1	IF232	Compulsory	
2	IF470	Computer Security	3	0	IF260	Compulsory	9, 17
3	IF420	Numerical Analysis	3	0	IF240	Compulsory	
4	IF450	Human and Computer Interaction	3	0	IF350	Compulsory	
5	IF432	Algorithm Design and Analysis	3	0	IF232	Compulsory	
6	IF440	Artificial Intelligence	3	0	IF360	Compulsory	
7	IF471	Computer Networks	3	0	IF260	Compulsory	
TOTAL CREDIT SEMESTER 4			**21**				

Semester 5

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF580	Computer Graphics and Animation	2	1	IF240	Compulsory	
2	IF540	Machine Learning	2	1	IF240; IF440	Compulsory	
3	IF570	Mobile App Programming	2	1	IF433	Compulsory	8,9

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
4	IF541	Expert System	3	0	IF440	Compulsory	
5	IF590	Information Technology Research	2	0	UM142	Compulsory	1,2,5,8, 9,10,17
6	EM604	Technopreneurship	2	0	-	Compulsory	10
7	UM321	English 3 : academic writing	2	0	UM223	Compulsory	
TOTAL CREDIT SEMESTER 5			**18**				

Semester 6

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IFM (MBKM schema – Compulsory Intership or other MBKM schema)	Internship (compulsory) Outreach program Study exchanges Independent Study Research Entrepreneurship Project Independent	Credit Conversion (15-20 credits for independent study or study exchange) Or		Min. 90 credit pass and have no D and E grade for all passes courses	Compulsory for Internship MBKM 1 (20 credits) and Elective for other schemes.	

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
			20 credits for other schemes				
TOTAL CREDIT SEMESTER 6			**20**				

Semester 7

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IFM (MBKM schema – Compulsory Intership or other MBKM schema)	Internship (compulsory) Outreach program Study exchanges Independent Study Research Entrepreneurship Project Independent	Credit Conversion (15-20 credits for independent study or study exchange) Or		Min. 90 credit pass and have no D and E grade for all passes courses	Compulsory for Internship MBKM 1 (20 credits) and Elective for other schemes.	

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
			20 credits for other schemes				
TOTAL CREDIT SEMESTER 6			**20**				

Semester 8

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF800	thesis		6	IF590; 122 credits(pass)	Compulsory	
TOTAL CREDIT SEMESTER 8			**6**				

Elective Course

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF680	Multimedia concept	3	0	IF580	elective	
2	IF681	3D Game Design and Development	1	2	IF433	elective	8,9
3	IF682	AR VR Game Design and Development	1	2	IF433	elective	8,9
4	IF670	Cross Platform Mobile Programming	2	1	IF570	elective	9
5	IF671	Blockchain and Cryptocurrencies	2	1	IF433	elective	9
6	IF672	Parallel Processing	2	1	IF260	elective	
7	IF673	Cybersecurity : Firewall configuration and management	2	1	IF 470; IF 471	elective	9
8	IF674	Cybersecurity : Cloud Security and Security Operations	2	1	IF 470; IF 471	elective	9
9	IF690	Computer and Society	3	0	-	elective	1, 2, 5, 8,9, 10,17
10	IF675	Cybersecurity Foundation	3	0	-	elective	

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
11	IF676	Digital Forensics	2	0	IF351; IF330; IF471; IF570	elective	
12	IF677	Cybersecurity : Ethical Hacking	2	1	IF351; IF330; IF471	elective	
13	IF683	Introduction to Bioinformatics	3	0	IF540	elective	
14	IF684	Deep Learning	2	1	IF540	elective	
15	IF685	Digital Image Processing	3	0	IF121; IF540	elective	
16	IF686	Cloud Computing	1	2	IF260	elective	
17	IF691	Startup Innovations	3	0	-	elective	17
18	IF692	Metaverse Foundation	2	1	-	elective	

Acceleration Path

Semester 1

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF130	Programming Fundamentals	3	0	-	Compulsory	
2	IF120	Discreate mathematics	3	0	-	Compulsory	
3	IF121	Linear Algebra	3	0	-	Compulsory	
4	IF150	Digital system	3	0	-	Compulsory	
5	UM162	Pancasila	2	0	-	Compulsory	16
6	UM152	Religion	2	0	-	Compulsory	
7	UM163	Civics	2	0	-	Compulsory	16
8	UM122	English 1: Composition	2	0	-	Compulsory	
TOTAL CREDIT SEMESTER 1			**20**				

Semester 2

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF260	Operating System	2	1		Compulsory	
2	IF232	Algorithm & Data structure	3	1	IF130, IF121	Compulsory	
3	IF231	Introduction to Internet Technology	2	1		Compulsory	

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
4	MSC1003	Communication and Personal Relationships	2	0	IF150	Compulsory	
5	IF240	Calculus	4	0		Compulsory	
6	IF250	Computer Architecture and Organization	3	0		Compulsory	
7	UM223	English 2 : speaking	2	0	UM122	Compulsory	
TOTAL CREDIT SEMESTER 2			**21**				

Semester 3

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF350	Software Engineering and Project Management	3	0	-	Compulsory	
2	IF330	Web Programming	2	1	IF231	Compulsory	
3	IF331	Declarative Programming	3	0	IF232	Compulsory	
4	IF332	Language Theory and Automata	3	0	IF120	Compulsory	
5	IF351	Database System	3	0	IF120	Compulsory	1,2,5
6	IF360	Probabilistic and Statistics	3	0	IF120	Compulsory	
7	UM142	Indonesian	2	0	-	Compulsory	

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
8	IFXX	Elective Course	3		-	elective	
TOTAL CREDIT SEMESTER 3			**23**				

Semester 4

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF433	Object Oriented Programming	2	1	IF232	Compulsory	
2	IF470	Computer Security	3	0	IF260	Compulsory	9, 17
3	IF420	Numerical Analysis	3	0	IF240	Compulsory	
4	IF450	Human and Computer Interaction	3	0	IF350	Compulsory	
5	IF432	Algorithm Design and Analysis	3	0	IF232	Compulsory	
6	IF440	Artificial Intelligence	3	0	IF360	Compulsory	
7	IF471	Computer Networks	3	0	IF260	Compulsory	
8	IFXX	Elective Course	3		-	elective	
TOTAL CREDIT SEMESTER 4			**24**				

Semester 5

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IF580	Computer Graphics and Animation	2	1	IF240	Compulsory	
2	IF540	Machine Learning	2	1	IF240; IF440	Compulsory	
3	IF570	Mobile App Programming	2	1	IF433	Compulsory	8,9
4	IF541	Expert System	3	0	IF440	Compulsory	
5	IF590	Information Technology Research	2	0	UM142	Compulsory	1,2,5,8, 9,10,17
6	EM604	Technopreneurship	2	0	-	Compulsory	10
7	UM321	English 3 : academic writing	2	0	UM223	Compulsory	
8	IFXX	Elective Course	6 (2 Courses)			elective	
TOTAL CREDIT SEMESTER 5			**24**				

Semester 6

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IFMXXX	Internship MBKM 1 (compulsory)	20		Min. pass 90 credits	compulsory	

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
2	IFXX	Elective Course (optional)	3		-	elective	
TOTAL CREDIT SEMESTER 6			**23**				

Semester 7

Num.	Course Code	CourseName	credits		Pre-requisite Course Code	Compulsory /Elective	SDG
			Lect.	Lab			
1	IFXX	Elective Courses	Min. 5 credits		-	elective	
2	IF800	Thesis	-	6	IF590; 122 credits (pass)	Compulsory	
TOTAL CREDIT SEMESTER 7			**Min. 11 credits**				

G. Course Description

Description of informatics study program containing Name of courses, amount credits, ELO, and short description from the courses.

Semester 1

Course	IF130 Programming Fundamentals
credits	3
ELO	ELO-2; ELO-6
Min Pass (Grade)	C
Description	This course discusses the design of structured programs, using flowcharts and pseudocode, which includes branching, iteration, desk checking, and modular.

Course	IF120 Discreate Mathematics
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	Discrete Mathematics aims to teach students to know and understand the basic concepts of Discrete Mathematics. Some of the materials taught in this course include the basic ideas of sets; Mathematical logic and proof; basic concepts of functions, sequences, and series; relations and relation matrices; introduction to number theory; calculation method; discrete opportunities; recurrence relations; graph and tree theory; and Boolean algebra and circuit combinatorial

Course	IF121 Linear Algebra
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	This course covers matrix theory and linear algebra, emphasizing topics useful in the computer science field

Course	IF150 Digital Systems
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	This course covers basic digital systems including the concept of digital systems, numbering systems and conversions, logic simplification, combination circuits, and sequential circuits

Course	UM162 Pancasila
credits	2
ELO	ELO-1
Min Pass (Grade)	C
Description	This course discusses Pancasila as the Philosophical basic values (philosophical grondslag), the soul of the nation (volksgeist) as well as the inner self of the nation, ideology of Indonesia, and Indonesian actual way of life

Course	UM152 Religion
credits	2
ELO	ELO-1
Min Pass (Grade)	C
Description	This course discusses the Divinity of God beyond any limitations as taught by every Religion in Indonesia; and its implications for human life

Course	UM163 Civics
credits	2
ELO	ELO-1
Min Pass (Grade)	C
Description	This course develops students' basic competencies to become scientists and professionals with strong strong values of nationalism and love of the homeland; democratic society; become citizens with competence and compliance; and actively participate in Indonesia's development

Course	UM122 English 1 : Composition
credits	2
ELO	ELO-3
Min Pass (Grade)	C
Description	This course discusses the elements of English to enrich the vocabulary, improve the pronunciation of words and improve students' knowledge related to sentence construction, paragraphs and texts that are focused on the development of reading skills, vocabulary skill-building and vocabulary learning strategies

Semester 2

Course	IF260Operating System
credits	3
ELO	ELO-2; ELO-7
Min Pass (Grade)	C
Description	This course covers operating systems, processes and threads, concurrency, process scheduling, memory management, multiprocessor, process synchronization, device settings, deadlock and solving, and file systems

Course	IF232 Algorithm and Data Structure
credits	4
ELO	ELO-2; ELO-6
Min Pass (Grade)	C
Description	This course equips students with knowledge of algorithms and data structures in programming with proper programming language

Course	IF231 Introduction to Internet Technology
credits	3
ELO	ELO-6
Min Pass (Grade)	C
Description	This subject teaches the basic concepts of Web programming using client-side scripting

Course	MSC1003 Communication and Personal Relationships
credits	2
ELO	ELO-3
Min Pass (Grade)	C
Description	The subjects include understanding, scope, concepts and axioms of communication, culture in interpersonal communication, perception and self in interpersonal communication, listening in interpersonal communication, interpersonal messages: verbal, nonverbal, emotion, and conversation, interpersonal relationships, interpersonal development and fractures, types of interpersonal relationships: friendship, romance, family and workplace, conflict and interpersonal conflict management, power and influence in interpersonal relationships

Course	IF240 Calculus
credits	4
ELO	ELO-2
Min Pass (Grade)	C
Description	This course provides basic concepts of limits and continuity; definitions, properties and derivative formulas and their applications; definitions and properties of transcendent functions and their applications; definitions, traits, indefinite integral and definite, derivatives and integrals of multivariable functions, application problems, and more

Course	IF250 Computer Architecture and Organization
credits	3
ELO	ELO-7
Min Pass (Grade)	C
Description	This course introduces details of computer architecture and organization. It covers computer

	top level view, memory types and hierarchies, I/O and Storage devices, CPU architectures such as RISC, CISC, parallel, multi-core and GPGPU systems

Course	**UM233 English 2 : speaking**
credits	2
ELO	ELO-3
Min Pass (Grade)	C
Description	This course discusses the concepts and processes of writing scientific articles (planning, designing, reviewing and editing) from writing paragraphs to writing essays, introducing literary variety and discussing the factors that influence the production of a good quality and well-written writing, as well as fostering students' writing habits

Semester 3

Course	**IF350 Software Engineering and Project Management**
credits	3
ELO	ELO-2; ELO-5; ELO-6
Min Pass (Grade)	C
Description	In this course students will apply the principles and approaches of software engineering theory and practice and manage them into a software project management that is efficient, within budget, quickly and of good quality. Students will develop a comprehensive project plan using the project of their choice. By the end of this course, students will understand why project management requires a high level of professionalism, and how to achieve that goal in future software projects

Course	**IF330 Web Programming**
credits	3
ELO	ELO-5; ELO-6

Min Pass (Grade)	C
Description	This course covers web programming using server side scripting (eg. PHP) and database

Course	**IF331 Declarative Programming**
credits	3
ELO	ELO-2; ELO-6
Min Pass (Grade)	C
Description	Declarative programming is a programming paradigm in which a computer program is formed based on a computational logic structure that can be used to solve a problem. In declarative programming, the source code of a program does not express the control flow of a problem solving. The purpose of using declarative programming is to minimize and eliminate side effects (in the form of bugs) from a program by describing what must be solved based on a problem domain. By understanding declarative programming, besides being able to create programs that are free from side effects, users can also write parallel programs more easily. Logical programming and functional programming are two parts of the declarative programming paradigm. This course will specifically discuss logic programming as part of declarative programming

Course	**IF332 Language Theory and Automata**
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	This course studies the formal language, especially for the purposes of designing a compiler and a text processor. Automata are abstract machines that can recognize, accept, or generate a sentence in a particular language. The theory of language and automata is a theory of abstract machines, and is closely related to formal language theory

Course	IF351 Database System
credits	3
ELO	ELO-4; ELO-6
Min Pass (Grade)	C
Description	This course covers the concepts, terminology, techniques used in database management systems

Course	IF360 Probability and Statistics
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	This course provides the basics of probability distribution and statistical analysis methods, relevant for students of information and communication technology.

Course	UM142 Indonesian
credits	2
ELO	ELO-3
Min Pass (Grade)	C
Description	This course covers the status and function of Bahasa Indonesia (Indonesian Language), traits of Bahasa Indonesia, variety / barrel of language, word and word formation, choice of words, sentences and sentence patterns, the effectiveness of sentences, paragraph development and paragraph sequencing, paraphrase, systematic scientific writing, writing excerpts with the APA system, completeness of papers, oral proficiency in presentations, interviews and arguments

Semester 4

Course	IF433 Object Oriented Programming
credits	3
ELO	ELO-6

Min Pass (Grade)	C
Description	This course deals with the basic concepts of object-oriented programming and Java and C ++ programming (Control Structure, I / O Stream, Function, Array, Pointer, String, Class, Operator Overloading, File, etc.)

Course	**IF470 Computer Security**
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	This course provides basic concepts and general knowledge of computer security, many kinds of attacks, harms caused by those attacks, vulnerabilities causing many kinds of attacks, threats which can exploit those vulnerabilities and cause security breach, and countermeasures against many kinds of attacks

Course	**IF420 Numerical Analysis**
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	In the Numerical Analysis course, students will be introduced to various numerical concepts, ranging from Linear Algebra and Systems of Linear Equations, Eigen values and vectors, Least Square Regression, Interpolation techniques, Taylor series, techniques for finding the roots of equations, Numerical derivatives, Integration Numeric , Ordinary Differential Equations, and Fourier Transforms. In addition, this course is also equipped with various examples of problems and practical applications of solving these problems using basic Python programming which is introduced to students.

Course	**IF450 Human and Computer Interaction**
credits	3

ELO	ELO-2
Min Pass (Grade)	C
Description	This course provides knowledge that focuses on fundamental concepts to real-world implementation examples of the principles of human-computer interaction in the world of information technology. Theories and techniques of analysis and design of human and computer interactions are explained with an understanding that most of them are in the realm of knowledge of informatics and computer engineering as well as a small part of human psychology in interacting with computers, general digital knowledge of today's interfaces and applications, and real-world conditions in society. related to interactive products in the world of information technology

Course	**IF432 Algorithm Design and Analysis**
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	This course discusses the analysis and design of algorithms that will be used to solve informatics problems where students will learn about the basic concepts of algorithms, algorithm analysis, algorithm design techniques, and how the algorithm works to solve a problem

Course	**IF440 Artificial Intelligence**
credits	3
ELO	ELO-2; ELO-9
Min Pass (Grade)	C
Description	This subject discusses the basic concepts of artificial intelligence and development, the concept follows the basic knowledge representation of knowledge, problem-solving techniques with search methods, and applications of intelligent systems applications in the field of artificial intelligence

Course	IF471 Computer Networks
credits	3
ELO	ELO-7
Min Pass (Grade)	C
Description	This course covers internetworking protocols (OSI and TCP / IP layers) and their implementation with a top-down approach, from the application layer to the physical layer

Semester 5

Course	IF580 Computer Graphics and Animation
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	Computer Graphics and Animation teaches computer graphics in general, procedural programming, basic algorithms for 2D and 3D graphics, geometric transformations, graphics between faces, lighting and animation. Apart from technical understanding, this course also teaches the history and application of computer graphics and animation in the industrial world

Course	IF540 Machine Learning
credits	3
ELO	ELO-2; ELO-4; ELO-9
Min Pass (Grade)	C
Description	Machine learning courses invite students to understand basic ideas, intuition, algorithm concepts and techniques to make computers smarter. Emphasis of material on technique the basis of guided, unsupervised, and reinforcement learning. Students are introduced to problem areas and problem boundaries in machine learning which includes classification and group analysis. Inviting students to understand and measure system performance, system optimization techniques and overcome overfitting

	problems, carry out preprocessing data, recognize data and its properties, and how to validate the correct model. Some of the algorithms used in developing machine learning based systems are presented to students are preprocessing data with principal component analysis and linear discriminant analysis, prediction-based models with regression, Gaussian-based modeling, modeling based on Bayes classification, decision tree based models, nearest neighbor based model, support vector based modeling, deep learning, partition algorithm, hierarchical algorithm, density based algorithm, association based algorithm, Q-Learning algorithm and SARSA

Course	**IF570 Mobile App Programming**
credits	3
ELO	ELO-5; ELO-6
Min Pass (Grade)	C
Description	This course provides the basic knowledge required by an Android mobile application programmer, such as the use of activity, fragments, and intents; UI concept on Android; utilization of views, data management; data sharing; Android messaging features; location-based services and Android services; Android networking; and Android application publishing, both theoretically and practically.

Course	**IF541 Expert System**
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	This course aims to teach students to know and understand the basic concept of the Expert System and its applications. Some of the materials being taught in this course are from the basic concept of an Expert System and the system's structure; Genetic Algorithm; some metaheuristic

	techniques (Particle Swarm Optimization, Ant Colony Optimization, Simulated Annealing, and Cross Entropy); and some Multi Criteria Decision Making techniques (Weighted Product Model, ELECTRE, TOPSIS, AHP, and Fuzzy-based MCDM). Moreover, the students will be given an experience to solve a problem by using the skills and knowledge they have learned in the form of a group project

Course	**IF590 Information Technology Research**
credits	2
ELO	ELO-3; ELO-8
Min Pass (Grade)	C
Description	Information Technology Research is a supporting course for the Thesis Course which contains the basic materials needed to ensure the success of a research project, such as the introduction of research in the field of Informatics Engineering, the basic concepts and stages of research, the basics of developing a research proposal, how to refer, test, and withdraw conclusions and research suggestions, and how to present research results, both orally and in writing

Course	**EM604 Technopreneurship**
credits	2
ELO	ELO-5; ELO-9
Min Pass (Grade)	C
Description	This course is about entrepreneurship based on Information and Communication Technology. This course is unique as students not only learn about entrepreneurship but also include creating an innovative idea by putting forward the latest technological aspects, realizing the idea to become a product or service, and how to deliver the product or service to the consumers

Course	UM321 English 3: academic writing
credits	2
ELO	ELO-3
Min Pass (Grade)	C
Description	This course covers methods, concepts and elements of language to improve listening and speaking skills in English which will enable students not only to understand and produce sentences related to grammatical, lexical and articulate elements but also to enable students to understand when, where, why and what ways should be applied to language production

Semester 8

Course	IF800 Thesis
credits	6
ELO	ELO-1; ELO2; ELO-3; ELO-4; ELO-6; ELO-8-ELO-9
Min Pass (Grade)	C
Description	This course trains students' abilities to develop to scientific fields of computer science or to continue their studies. In this course, students will work on research topics independently under the guidance of a lecturer. The research topic being worked on must be related to one of the fields in the research lab in the Study Program. Students must write a scientific report regarding their work and defend it at the Final Assignment Session.

Elective Courses

Course	IF680 Multimedia Concept
credits	3
ELO	ELO-2
Min Pass (Grade)	C
Description	Multimedia concept teaches students the basic understanding of the concept of using multimedia elements and their processing in the real world. This course teaches various terms, definitions, technical meanings and techniques for using

	multimedia elements consisting of text, image, audio, video, and animation. In addition, students are also taught to complete a multimedia project in the form of collaborative interactive multimedia applications. The technique of using multimedia elements and making interactive multimedia projects is done using the Visual Scratch programming language as a multimedia authoring tool

Course	**IF681 3D Game and Development**
credits	3
ELO	ELO-2; ELO-5; ELO-6
Min Pass (Grade)	C
Description	This course discusses the process of making a digital game in 3-dimensional form, starting from the process of designing elements in a game and using three-dimensional assets from 3D software, to the process of implementing and programming a digital game in three-dimensional form. Before entering into the process of designing elements in a game, students will be taught the concept of elements in a game according to several experts in the field of Game Design and Development. The implementation and programming technology taught in this course will use the Unity Game Engine as a digital game development tool

Course	**IF682 AR VR Game Design and Development**
credits	3
ELO	ELO-2; ELO-5; ELO-6
Min Pass (Grade)	C
Description	This course discusses the process of making a digital game in 3-dimensional form by utilizing tools related to making game development such as smartphones to create Virtual Reality games or Augmented Reality games and also learning how to make games using procedural content generation methods by utilizing Unity software

Course	IF670 Cross Platform Mobile Programming
credits	3
ELO	ELO-5; ELO-6
Min Pass (Grade)	C
Description	Cross-Platform Mobile Programming discusses how to build a hybrid mobile app using various web technologies that can run on Android and iOS platforms using the same codebase. Students will also learn how to build mobile applications that can access native device features, such as cameras, sensors, geolocation, and access cloud-based databases

Course	IF671 Blockchain and Cryptocurrencies
credits	3
ELO	ELO-2; ELO-4; ELO-6
Min Pass (Grade)	C
Description	This course explores the potential use of blockchain technology by various stakeholders related to economics and finance. Starting with a review of the early applications of the technology, Bitcoin cryptocurrency, students will gain an understanding of the commercial, technical, and public policy underpinnings of blockchain technology, distributed ledgers, and smart contracts in open source and private applications. The discussion covers current blockchain applications with case reviews from payment systems to non-fungible tokens (NFT)

Course	IF672 Parallel Processing
credits	3
ELO	ELO-2; ELO-6
Min Pass (Grade)	C
Description	This course covers the theory of concurrency and parallelism, the history of high-performance machines and how to use high-performance computing facilities such as computing on clusters and GPUs.

	Students will be taught theories about the parallel programming paradigm, SOMD and MIMD engine concepts, as well as issues such as shared memory, mutual exclusion, and semaphores, and also be equipped with practical knowledge about the latest standards such as Open MP, Cuda and so on

Course	**IF674 Cybersecurity : Cloud security and Security Operations**
credits	3
ELO	ELO-1; ELO-4; ELO-9
Min Pass (Grade)	C
Description	This course provides the students basic principles associated with securing the cloud and SaaS-based applications through Secure Access Service Edge architecture and identify concepts required to recognize and potentially mitigate attacks against traditional and hybrid datacenters as well as mission critical infrastructure. Students will also learn how to initially setup and configure containers on a Docker bridge network and test the container security through the use of vulnerability scans and reports. This course also provides the student with an understanding of Security operations (SecOps) and the role it plays in protecting our digital way of life, for businesses and customers. Students will learn continuous improvement processes to collect high-fidelity intelligence, contextual data, and automated prevention workflows that quickly identify and respond to fast-evolving threats. They will also learn how to leverage automation to reduce strain on analysts and execute the Security Operation Center's (SOC) mission to identify, investigate and mitigate threats

Course	**IF673 Cybersecurity : firewall configuration and management**
credits	3
ELO	ELO-4; ELO-7

Min Pass (Grade)	C
Description	This course provides students with a general understanding of how to install, configure, and manage firewalls for network architecture defense. Students will learn theory and configuration steps for setting up security, networking, threat prevention, logging, and reporting features of firewall technology. Students will also learn the theory and advanced configuration features needed to set up traffic handling, advanced content/user identification, quality of service, global protection, monitoring/reporting, and high availability using firewall technology.

Course	**IF690 Computer and Society**
credits	3
ELO	ELO-1; ELO-3; ELO-9
Min Pass (Grade)	C
Description	The rapid development of ICT (Information and Communication Technology) has changed many activities in our lives. For example, in learning, playing, working, communicating and doing business. Moreover, now social media has also been widely used in various ways. In addition to having a positive impact, the development of ICT also has a negative impact. This negative impact needs to be understood so that the community using ICT can minimize its impact. To that end, the Indonesian government has drawn up various laws, including the Law on Information and Electronic Transactions to regulate the use of ICT in society. As an ICT professional, it is not enough just to master the technology but also to understand the code ethics to prevent the misuse of ICT, both for personal interests and the interests of other parties

Course	**IF675 Cybersecurity Foundation**
credits	3

ELO	ELO-1; ELO-2
Min Pass (Grade)	C
Description	This course is designed to help participants understand the fundamental principles and concepts of cybersecurity. The main objective of this course is to equip participants with the basic knowledge needed to identify and address security threats in computer systems and networks, as well as introduce them to various tools, technologies, and best practices in cybersecurity.

Course	**IF676 Digital Forensics**
credits	2
ELO	ELO-1; ELO-2; ELO-3; ELO-4
Min Pass (Grade)	C
Description	This course is designed to provide the knowledge and skills needed in the field of digital forensics, which involves the use of scientific techniques and analysis in the investigation of crimes involving electronic data and systems. The main objective of this course is to equip participants with an in-depth understanding of the principles, methods and tools used in digital forensics, as well as teaching them how to apply this knowledge in professional practice.

Course	**IF677 Cybersecurity : Ethical Hacking**
credits	3
ELO	ELO-1; ELO-2; ELO-3; ELO-4
Min Pass (Grade)	C
Description	This course is designed to provide the knowledge and skills needed in the field of cybersecurity, with a focus on ethical hacking techniques. The main objective of this course is to equip participants with an in-depth understanding of the concepts, principles, and practices of ethical hacking so that they can identify and address potential security threats in computer systems and networks.

Course	IF683 Introduction to Bioinformatics
credits	3
ELO	ELO 2; ELO 4; ELO 8
Min Pass (Grade)	C
Description	This course introduces students to the resources needed to apply various approaches to artificial intelligence to generate information for biological applications such as gene function, gene structure, protein structure and molecular evolution. students are taught methods for mining and data analysis to perform sequence matching, similarity search, phylogenetic analysis, gene search and protein structure prediction

Course	IF684 Deep Learning
credits	3
ELO	ELO-2; ELO-6
Min Pass (Grade)	C
Description	This course covers the basic concepts of deep learning, as well as deep learning workflows, deep learning computational frameworks, implementation practicalities, and state of the art of deep learning models.

Course	IF685 Digital Image Processing
credits	3
ELO	ELO-2; ELO 4; ELO-6
Min Pass (Grade)	C
Description	This course discusses data processing methods in the form of 2D images or images, as well as the basic concepts of pattern recognition, which can be applied to various fields such as remote sensing, medical diagnosis, document processing, robotics and so on. Topics that will be discussed include the basic concepts of digital images, image transformation, image enhancement and restoration, color

	transformation, morphology, compression, segmentation, feature extraction and selection, clustering, image classification, performance evaluation, intelligent multimedia information processing, soft computing , and self-taught. -learning. students will be trained with programming assignments with appropriate programming languages both individually and in groups

Course	**IF686 Cloud Computing**
credits	3
ELO	ELO-7
Min Pass (Grade)	C
Description	This lecture contains the concept and application of cloud computing-based information technology infrastructure. Topics taught in this lecture include: IaaS (Infrastructure as a Service), PaaS (Platform as a Service), SaaS (Software as a Service) and supporting technologies for the implementation of cloud computing infrastructure such as hypervisors, virtual servers and containers. The purpose of this course is to provide students with knowledge in the process of designing and implementing cloud computing-based technologies and to assist students in combining various tools and technologies in implementing cloud computing-based infrastructure

Course	**IF691 Startup Innovation**
credits	3
ELO	ELO-1; ELO-2; ELO-3; ELO-4; ELO-6; ELO-9
Min Pass (Grade)	C
Description	This course will guide the students step by step how to establish a startup company, starting from observing problems, needs and wants in the society, doing feasibility study, business canvas, business model, financial simulation, prototyping,

	product testing, and online marketing and legal aspects.

Course	IF692 Metaverse Foundation
credits	3
ELO	ELO-1; ELO-3; ELO-4; ELO-9
Min Pass (Grade)	C
Description	This course aims to provide a deeper understanding of the metaverse and offer students a glimpse of the emerging future of the web and the way we will interact with it. The insight and following key of this course are : know what it means of metaverse; explore various technologies involved in metaverse, learn how students can get started with metaverse, and explore different use cases of metaverse.

MBKM in Informatics Study Program

	code	Courses	ELO-1	ELO-2	ELO-3	ELO-4	ELO-5	ELO-6	ELO-7	ELO-8	ELO-9
	MBKM Internship (compulsory)										
1	IFM601	Professional Business Ethics	v			v		v			
2	IFM602	IndustryExperience		v	v	v		v			
3	IFM603	Industry Model Validation		v		v		v			
4	IFM604	Evaluation and Reporting			v	v		v			
MBKM Internship (elective)											
5	IFM701	Industry Pipeline Knowledge		v				v			
6	IFM702	Professional Literacy				v					
7	IFM703	Industry Pipeline validation						v			
8	IFM704	Industry-based projects		v				v			
Entrepreneurship											
9	IFM711	Idea validation		v							
10	IFM712	Product validation					v				
11	IFM713	Business validation		v			v				
12	IFM704	Business mentoring					v	v			
Research											

	code	Courses	ELO-1	ELO-2	ELO-3	ELO-4	ELO-5	ELO-6	ELO-7	ELO-8	ELO-9
13	IFM721	Research problem formulation		v							
14	IFM722	Implementation of research methodology		v						v	
15	IFM723	Research evaluation		v							
16	IFM724	Scientific publications						v		v	
Community Service Program											
17	IFM731	Community outreach project idea		v							
18	IFM732	Community outreach (Phase 1)		v				v			
19	IFM733	Socio entrepreneurship development & managing				v		v			
20	IFM734	Community outreach (phase 2)								v	
Independent Project											
21	IFM741	Generations		v							
22	IFM742	Design creation						v			
23	IFM743	Development and evaluation		v				v			
24	IFM744	Publications								v	