ANNEX 1





Curriculum Document of

COMPUTER SCIENCE STUDY PROGRAMME (BACHELOR DEGREE)

FACULTY OF ENGINEERING AND VOCATIONAL

Universitas Pendidikan Ganesha 2021

1. **IDENTITY**

1	Name of Study Programme, Level	Computer Science, Bachelor Degree
2	Address	Udayana Street no. 11 Singaraja,81116
3	Regency/City	Singaraja
4	Postal code	81116
5	Phone number	(+62362) 25571
6	Fax Number	(+62362) 25571
7	Email address	ilmukomputer@undiksha.ac.id
8	Website address	https://cs.undiksha.ac.id
9	Degree given	Bachelor of Computer Science (S.Kom)
10	Year and Decree of Establishment	The Decree of the Director General of Higher Education Number 548/KPT/1/2018
11	Year and Decree of Accreditation	The Decree of the BAN-PT Number 12209/SK/BAN-PT/Akred/S/XI/2021

2. LEADERSHIP OF THE STUDY PROGRAMME

1	Name	A.A. Gede Yudhi Paramartha, S.Kom., M.Kom.
2	Position	Head of the Study Programme
3	Decree of Assignment	2831/UN48/KP/2019
4	Assignment start date	December 2, 2019
5	Assignment complete date	November 30, 2023

A. RATIONALE

To provide appropriate standards for the quality of graduates and good acceptance by the workfare requirements, the curriculum must be compiled according to the needs in the world of work. The involvement of stakeholders as external elements of employers will later be important in preparing the curriculum used today. Obtaining information related to these needs is carried out through tracer studies, FGDs (Focus Group Discussion) with the business world and industry, as well as searching for information in the surrounding community. These results are compared with the projected progress of computing work presented in the 2020 annual computing curricula report by ACM. Of course, the regularity of the learning plan must be well prepared based on the guidelines issued by the institutions or scientific community groups with related expertise, such as the computer science curriculum.

The formulation of the curriculum is carried out by aligning the inputs obtained from the external elements mentioned before with the direction of national education policies. Through the inauguration of *Merdeka Belajar Kampus Merdeka* (MBKM) or also known as Freedom to Learn - Independent Campus, the resulting curriculum must accommodate the flexibility of both in the learning process and the ability of graduates to implement their skills across disciplines. Meanwhile, alignment with the institution's vision and mission should also be maintained to produce graduates who are able to demonstrate excellence at the international level.

Thus, several important things can be seen from the compiled 2020 curriculum: an understanding of computer science; problem-solving capability; experience in working on information technology/computer science-based projects; a commitment to responsibility; and awareness of the breadth of potential applications. Computing technology.

B. DESCRIPTION OF STUDY PROGRAMME PROFILE

As a faculty that carries out an important task in developing human resources' quality through the development of technological literacy, *Unit Pengelola Program Studi* (UPPS) or Study Programme Management Unit cannot be separated from the development of information technology which becomes the main factor in the disruption era based on cyber-physical systems. This is an important point proclaimed in UNDIKSHA's strategic plan to determine the direction of institutional development. The Computer Science Study Programme was established to answer these challenges based on Indonesia's Minister of Research, Technology, and Higher Education Decree Number. 548/KPT/2018 in 2018.

Three scientific domains become the core scope of the learning and research process. This is stated in the graduate profile of the study programme, which includes software engineering, data science, intelligent systems and infrastructure, and cyber security. Software engineering concentrates on courses that support software development with the latest technology, whether based on desktop, web, or mobile. The intelligent data-based system focuses on courses that utilize the concept of artificial intelligence to teach computer machines so that they can make decisions based on the results of the data analysis. Meanwhile, students can also choose to explore network concepts, implementation, and security, including cloud computing technology.

Research conducted by lecturers is also based on these three disciplines that collaborate with other fields such as governance, health, and others. Research activities also involve student participation, both as part of engineering and in implementing the research itself. Thus, students can hone their experience intra-curricular through class meetings and extracurricular.

C. VISION AND MISSION

The vision of the Computer Science Study Programme

"To be a Leading Study Programme in the field of Computer Science Based on the *Tri Hita Karana* (Three Causes to Prosperity) Philosophy in Asia by in 2045"

The mission of the Computer Science Study Programme

The missions of the Computer Science Study Programme are:

- 1) Providing qualified education to produce competitive, collaborative, and characterized human resources.
- 2) Building a competitive, collaborative, and creative academic atmosphere oriented towards scientific development through information technology-based research.
- 3) Organizing the dissemination of appropriate information technology to the public
- 4) Organizing educational and research collaborations with industries in order to improve the quality of the study programme and the graduates.

D. OBJECTIVES

The objectives of the Computer Science Study Programme are:

- 1) Produce computer science graduates who have competencies according to national and international standards, have noble personalities and have an entrepreneurial spirit.
- 2) Produce both innovative and quality works and products in the field of information and computer technology by prioritizing morals and ethics and supported by sustainable resource development.
- 3) Carry out activities and produce products in the field of computer science in a sustainable manner for community empowerment in order to support national development.
- 4) The establishment of both national and international collaboration with various related parties in computer science clusters.

Profile of Graduate	Description
Software engineer	Serving as a systems analyst and/or developer of software and its database. This profile can also develop creative technologies such as virtual reality, augmented reality, games, and other creative technologies.
Professional in data science and intelligent systems	Build intelligent systems to solve various problems by utilizing large amounts of diverse data.
Professional in IT infrastructure and security	Design and build networks and infrastructure on a small or large scale, and perform maintenance and maintain network security.

E. PROFILE OF GRADUATE

F. LEARNING OUTCOMES OF GRADUATES

1. ATTITUDE					
PLO1	Demonstrate scientific, educational, and religious attitudes and behaviors that improve the quality of life in society, nation, and state-based on academic norms and ethics based on <i>Tri Hita Karana</i> values.				
2. KNOWL	EDGE				
PLO4	Mastering the theoretical concepts of computer science in general, such as mathematics, algorithms, programming, and databases				
PLO5	Mastering the theoretical concepts of software engineering, data science and intelligent systems, and cybersecurity and infrastructure				
PLO6	Mastering the operational concepts of methodologies in software development, data science, and intelligent systems, as well as infrastructure and cybersecurity in solving contextual problems that benefit society				

3. GENERA	3. GENERAL SKILLS					
PLO2	Able to integrate learning and innovation skills, mastery of technology and information, career development, and life skills to become lifelong learners.					
PLO3	Able to apply logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise.					
4. SPECIAI	4. SPECIAL SKILLS					
PLO7	Able to perform requirement analysis, design and implement as well as to evaluate enterprise software and creative technology-based products					
PLO8	Able to extract information from various data sources, design and implement systems for automation and effective decision making					
PLO9	Able to implement network-based systems, apply protection methods that threaten the confidentiality, integrity, availability, and security of information					

G. LEARNING PROCESS

UNDIKSHA carries out the learning process under the Minister of Research, Technology, and Higher Education Decree Number 44 of 2015 concerning National Standards for Higher Education. The learning process has the characteristics of interactive, holistic, integrative, scientific, contextual, thematic, effective, collaborative, and student-centered learning.

The learning process for each course is planned and compiled in the form of *Rencana Pembelajaran Semester* (RPS) or Semester Learning Plan. This RPS is prepared by the lecturer or a group of lecturers of the same expertise in the study programme. The learning process is carried out by following the RPS that has been developed and must be carried out systematically and structured into courses with a measurable learning load.

The learning process is conducted through interaction between lecturers, students, and other learning resources. The learning process is carried out with certain methods according to the courses' characteristics in order to meet the learning outcomes of graduates. The chosen learning methods are group discussions, problem-based learning, project-based learning, and case study. Other methods can also be used as long as they are inline with the graduate learning outcomes. In the running of a course, it is allowed to adopt one or more learning methods into a certain form of learning. The forms of learning can be lectures, tutorials, seminars and lab work, and fieldwork practices.

The learning process carried out by the Computer Science Study Programme follows the standards of the Ministry of Research, Technology, and Higher Education, which consists of lesson plans prepared in the form of Semester Learning Plan (RPS), implementation of learning, and evaluation of learning outcomes, attendance rates of lecturers and students. Each course is equipped with a textbook/handout/lecture notes.

One semester consists of 16 class meetings including the *Ulangan Tengah Semester* (UTS) or Mid-Semester Examination, and the *Ulangan Akhir Semester* (UAS) or Final Semester Examination. Students are eligible to take the final exam if the attendance rate is at least 75% of the meetings. The Study Programme encourages lecturers to apply student-centered learning methods, problem-based learning, or project-based learning. Lecturers have more roles as facilitators in the learning process. In the implementation of this learning process, several factors influence students, including:

- 1) Students' Internal Factors
 - a. Physiological, which is related to the physical condition of students
 - b. Psychological factors, which are related to intelligence, attitudes, interests, talents, student motivation, such as moods, student relationships with lecturers and fellow students

- 2) Students' External Factors
 - a. Social environment
 - b. Non-social environments, such as accessibility to learning resources and time constraints
 - c. The learning approach, like the previous learning process, the relevance of the learning process to actual working conditions

The learning process carried out in the Computer Science Study Program is a learning process for adults marked by a shift in learning responsibilities from lecturers to students. This change in responsibility requires students to be actively involved in the learning process (be active learners). The learning process runs interactively between lecturers and students. Learning resources can be obtained from libraries, the internet, laboratories, etc. In essence, the lecturer only acts as a facilitator. The Computer Science study programme facilitates students with computer laboratories that are open for students to use. In addition, throughout the Undiksha area, including the Computer Science study program, free Wifi access is available for students.

Several learning methods allow students to be actively involved in learning: case studies, team discussions, project-based learning, and others. This method allows students to do many activities during and outside class, focus on the material, analytical practice skills, and receive feedback, training their social sensitivity. The following is the learning experience that students will obtain.

Course Outcome	Code of CO	Learning experiences
• Students can apply an attitude of tolerance and apply the noble values of Pancasila and <i>Tri Hita Karana</i> in a multicultural environment	CLO1	Face to face, group discussion, presentation
• Students can explain the basic concepts of computer science	CLO2	Face-to-face, group discussions, presentations, seminars, group projects
• Students can explain mathematical and logical concepts that support the scientific field of computer science	CLO3	Face to face, group discussion, presentation
 Students can explain expertise in other fields of science Students can identify scientific topics outside the field of Computer Science 	CLO4	Face-to-face, group discussions, presentations, independent projects, group projects
 Students can communicate effectively Students can explore creative and innovative ideas 	CLO5	Face-to-face, group discussions, presentations, seminars, group projects
 Students can think systematically in analyzing problems according to their scientific field Students can design solutions to existing problems according to their scientific field Students can apply effective problem-solving methods 	CLO6	Face-to-face, group discussions, presentations, seminars, independent projects
 Students can think systematically in analyzing and designing software and database solutions Students can apply effective methods in developing software and databases Students can develop and evaluate software and database solutions 	CLO7	Face to face, group discussion, presentation, lab work, independent project, group project
• Students can think systematically in choosing	CLO8	Face to face, group discussion,

 information technology architecture Students can analyze information technology infrastructure needs Students can design information technology infrastructure solutions 		presentation, lab work, independent project, group project
 Students can think systematically in analyzing and designing intelligent system solutions Students can apply effective methods in developing intelligent systems Students can implement and evaluate intelligent systems 	CLO9	Face to face, group discussion, presentation, lab work, independent project, group project

H. ASSESSMENT

The assessment of the learning is an evaluation of the students' learning processes and accomplishments throughout the semester, referring to the students' learning outcomes and graduates learning outcomes that have been specified by the study programme. It is related to assessment principles, assessment techniques and instruments, assessment mechanisms and procedures, assessment implementation, assessment reporting, and student learning achievements.

The principles of the assessment include the principles of educative, authentic, objective, accountable, and transparent which are performed in an integrated manner. The techniques in assessing the students' learning process and outcomes can be performed using observation, participation, performance, written tests, oral tests, and questionnaires. The instruments used to assess the learning process are in the form of a rubric and/or in the form of a portfolio, while the observation can be used to assess the attitude. The assessment of the mastery of knowledge, general skills, and special skills is done by using one or a combination of various assessment techniques and instruments (e.g. observation, participation, performance, written test, oral test, and questionnaire).

Assessment of student learning outcomes can be assessed when the face-to-face lecture has met the target of 75% of the 16 meetings (the number of meetings ineffective learning) and the lab work meeting has been accomplished 100%. If these requirements have not been met, the lecturer must give additional meeting(s) and provide an evaluation before submitting grades. For students who do not attend lectures with a target of at least 75% of the number of effective lectures, the student concerned is not allowed to take the final semester exam in the subject concerned. The value of the subject in question is E. The assessment reference for all courses uses *Penilaian Acuan Patokan* (PAP) or the Benchmark Reference Assessment which can be seen in the following table.

Percentile Score	Scale Value	Letter Score
85 - 100	4,00	А
81 - 84	3,75	A-
77 – 80	3,25	B+
73 – 76	3,00	В
69 - 72	2,75	В-
65 - 68	2,50	C+
61 - 64	2,00	С
40 - 60	1,00	D
0 - 39	0,00	E

In the administrative process, the creditable value is C and above. For the S1 Programme, the D test score can be credited if it can be compensated with B or A scores obtained from other courses in the same group, and the credit weight is not less than the compensated course. The number of D grades that can be compensated at the end of the programme is a maximum of 10 credits. Specifically for Religion

and Pancasila courses, the minimum score is C, while the minimum value for PPL courses is B and cannot be compensated. Each study programme determines more detailed compensation rules. In comparison, the test score of E cannot be credited. Students who get an E grade must re-enter lectures in the relevant subject in the next odd/even semester, provided that the credit study load is taken into account in setting the maximum credit limit that can be taken in that semester.

Outcomes	Outcomes Kinds of Assessment			
PEO1, PEO2, PEO3	Employer satisfaction surveyAlumni Survey	Few years after graduation		
PLO1, PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8, PLO9	 Instructor evaluation report Department/Study Programme performance Report Student exit survey 	Upon graduation		
CLO1, CLO2, CLO3, CLO4, CLO5, CLO6, CLO7, CLO8, CLO9	 Direct assessment End of the course assessment Semester performance report Students report/comments 	Upon course completion		

I. CURRICULUM STRUCTURE

The Computer Science Study Programme curriculum is based on the *Kerangka Kualifikasi Nasional Indonesia* (KKNI) or Indonesian National Qualifications Framework level 6. Curriculum evaluation and updating are prepared based on several references from within the country and abroad and involve several stakeholders from internal and external parties. The main reference used refers to the Academic Paper of the KKNI for the Informatics and Computer Sciences Group compiled by the Association for Higher Education in Informatics and Computers (APTIKOM). The second reference refers to the IEEE/ACM Computer Science Curricula.

The curriculum was prepared to invite several internal stakeholders such as curriculum experts at Undiksha and collaborate with related study programmes. From external parties, curriculum evaluation involves experts from the ICT industry, such as from the software development industry (software house) and several experts from government agencies working in the ICT field. In terms of meeting the development of science and technology and user needs, several things are considered very important related to the compiled curriculum. Among them are increasing the number of credits for courses related to the use of English (with the hope that graduates can compete abroad) and holding cross-study courses (to enrich the knowledge of graduates to face the dynamic world of work). Recognition in the MBKM programme is also stated in the curriculum, where students can take the MBKM programme in semesters 6 and 7.

Computer Science study programme divides courses into five categories which are:

- Prodi Ilmu Komputer membagi mata kuliah menjadi 5 kategori, yaitu:
 - 1. Mata Kuliah Wajib Umum (MKWU) or Compulsory Courses;
 - 2. Mata Kuliah Inti Keilmuan (MKIK) or Core Study Courses;
 - 3. Mata Kuliah Keilmuan Bidang Studi (MKBS) or Field of Study Courses;
 - 4. Mata Kuliah Iptek Pendukung (MKIP) or Supporting Science and Technology Courses; and
 - 5. Mata Kuliah Penciri Institusi (MKPI) or Educational Science Courses .

The MKWU is a group of compulsory courses for the students of Undiksha to pass during their studies. The MKIK consists of required courses to be taken by the Computer Science Study Programme

students. The courses included in MKBS are courses specifically offered by the Study Programme and developed based on the current trend in the related fields. The MKIP contains the supporting courses from the outside of the study programme. Meanwhile, the MKPI is the group of courses that uniquely characterizes the university.

MKWU, MKIK, and MKPI contain required courses for the students, consisting of 36 courses or equivalent to 98 credits. The MKBS and MKIP consist of several courses that students can choose, where the study programme determines the number of courses that should be taken. The MKBS is a group of courses taken by students based on the targeted specialty and has already been discussed with the academic supervisor. The Computer Science Study Programme has specified that students should take seven courses or 21 credits for this course group. The MKIP courses are provided to prepare the students to have excellent soft skills, interpersonal skills and expand their knowledge outside of the computer science Study Programme students or equal to 26 credits.

Several considerations were taken regarding the curriculum development to align with the current technology-oriented proficiency requirements. The addition of the English-based courses and the enforcement of interdisciplinary courses are two major implementations to improve students' competitiveness. English is the widely used international language, while the interdisciplinary study could enrich the graduates' knowledge to face the dynamic world of work. The MBKM program's recognition should be included in the curriculum, and therefore the students could take the MBKM programme in semesters 6 and 7. Furthermore, students are required to complete their thesis or final project, which is equal to 6 credits included in the MKIK group. Therefore, the students should pass 145 credits during their studies.

Based on the SN-DIKTI, the conversion of 1 credit is equal to 170 minutes of course weekly. There are three modes of courses: the face-to-face class, the tutorial/seminar, and the lab work course. The face-to-face model consists of 50 minutes of face-to-face (theoretical) class activity, 60 minutes of structured activities, and 60 minutes of independent activity. The tutorial/seminar mode consists of 100 minutes of face-to-face activity and 70 minutes of independent activity. Meanwhile, the lab work course consists of 170 minutes of lab activities. There are a total of 14 meetings for each course in one semester. The accumulation of minutes used by the students for their activities is 2.720 minutes or 45.3 hours for each credit per semester. Referring to the European Credit Transfer and Accumulation System (ECTS), one ECTS equals 25 hours per semester. Therefore, the students will spend 238 minutes or 39.6 hours per semester in a semester. Since one credit is equal to 1.5 ECTS, therefore the total of 145 credits will be equivalent to 217.5 ECTS.

		Credits			
Number	Course Category	Numbers Offered	Students' Obligation		
1.	Mata Kuliah Wajib Umum (MKWU) Compulsory Courses	20	10		
2.	Mata Kuliah Inti Keilmuan (MKIK) Core Study Courses	86	86		
3.	Mata Kuliah Keilmuan Bidang Studi (MKBS) Field of Study Courses	63	21		
4.	Mata Kuliah Iptek Pendukung (MKIP) Supporting Science and Technology Courses	26	26		
5.	Mata Kuliah Penciri Institusi (MKPI) Educational Science Courses	2	2		
	Total	197	145		

The following is the distribution of subject categories in the Computer Science study programme:

The following is the curriculum structure of the Computer Science study programme by category:

Mata K	uliah	Waiib	Umum	(MKWU) or	Com	pulsorv	Courses
TITUTE T		,, ujio	Chithin		,	Com	puisory	Courses

	Course	C l'tr	Semester							
Course Code		Creatts	1	2	3	4	5	6	7	8
KOMS120106	Pancasila	2	2							
KOMS120107	Indonesian	2	2							
KOMS120208	Civic Education	2		2						
KOMS120209	English	2		2						
KOMS120210	Hinduism*	2		2						
KOMS120211	Islam*	2		2						
KOMS120212	Catholic christianity*	2		2						
KOMS120213	Protestant Christianity*	2		2						
KOMS120214	Buddhism*	2		2						
KOMS120215	Confucianism*	2		2						
	Total	20	4	16	0	0	0	0	0	0

Notes:

* Students choose one of 6 religion courses.

Mata Kuliah Inti Keilmuan (MKIK) or Core Study Courses

						Sem	ester			
Course Code	Course	Credits	1	2	3	4	5	6	7	8
KOMS120101	Basic Math	3	3							
KOMS120102	Algorithms and Programming	3	3							
KOMS120103	Digital System	3	3							
KOMS120104	Introduction to Information Technology	3	3							
KOMS120105	Human Computer Interaction#	3	3							
KOMS120201	Calculus	3		3						
KOMS120202	Data Structures and Algorithms	3		3						
KOMS120203	Computer Architecture and Organization	3		3						
KOMS120204	Database	3		3						
KOMS120205	Data Communication	3		3						
KOMS120206	Algorithm and Programming Lab	1		1						
KOMS120207	Database Lab	1		1						
KOMS120301	Linear Algebra	3			3					
KOMS120302	Object Oriented Programming	3			3					
KOMS120303	Statistics	3			3					
KOMS120304	Discrete Mathematics	3			3					
KOMS120305	Numerical Method	3			3					
KOMS120306	Web Technology	3			3					
KOMS120307	Computer Network	3			3					
KOMS120308	Computers and Society	2			2					
KOMS120309	Computer Network Lab	1			1					
KOMS120401	Operating System	3				3				
KOMS120402	Research Methodology	3				3				

			Semester								
Course Code	Course	Credits	1	2	3	4	5	6	7	8	
KOMS120403	Algorithm Design and Analysis	3				3					
KOMS120404	Artificial Intelligence	3				3					
KOMS120405	Distributed System	3				3					
KOMS120406	Software Engineering	3				3					
KOMS120407	Data Science	3				3					
KOMS120408	Object-Oriented Analysis and Design	3				3					
KOMS120801	Thesis	6								6	
	Total	86	15	17	24	24	0	0	0	6	

Mata Kuliah Keilmuan Bidang Studi (MKBS) or Field of Study Courses

Course Code	Course	Credita	Semester								
Course Coue	Course	Creuits	1	2	3	4	5	6	7	8	
KOMS120501	Service-Oriented Architecture*	3					3				
KOMS120502	Mobile Application Development*	3					3				
KOMS120503	Information Retrieval**	3					3				
KOMS120504	Data Mining**	3					3				
KOMS120505	Inter-Network Technology***	3					3				
KOMS120506	Information Security***	3					3				
KOMS120603	Software Testing*	3						3			
KOMS120604	Software Project Management*	3						3			
KOMS120605	Creative Technology Development*	3						3			
KOMS120606	Expert System**	3						3			
KOMS120607	Digital Image Processing**	3						3			
KOMS120608	Pattern Recognition**	3						3			
KOMS120609	Internet of Things***	3						3			
KOMS120610	Cyber Security***	3						3			
KOMS120611	Parallel Computing***	3						3			
KOMS120705	Geographic Information System*	3							3		

Course Code	Course	Credita	Semester								
Course Coue	Course	Creuits	1	2	3	4	5	6	7	8	
KOMS120706	Enterprise Architecture *	3							3		
KOMS120707	Robotics**	3							3		
KOMS120708	Decision Support System**	3							3		
KOMS120709	Data Center Architecture***	3							3		
KOMS120710	Cloud Computing***	3							3		
	Total	63	0	0	0	0	18	27	18	0	

Description:

- * Software Engineering Elective Courses
- ** Data Science and Intelligent Systems Elective Courses
- *** Infrastructure and Network Security Elective Courses

Mata Kuliah Iptek Pendukung (MKIP) or Supporting Science and Technology Courses

Course Code	Course	Cradita	Semester								
Course Code	Course	Creuits	1	2	3	4	5	6	7	8	
KOMS120507	Interdisciplinary Course 1	3					3				
KOMS120508	Interdisciplinary Course 2	3					3				
KOMS120509	Interdisciplinary Course 3	3					3				
KOMS120510	Community Engagement	4					4				
KOMS120601	Capita Selecta	3						3			
KOMS120602	English Communication	2						2			
KOMS120701	Technopreneur	2							2		
KOMS120702	Professional Ethics	2							2		
KOMS120703	English for Information Technology	2							2		
KOMS120704	Interpersonal Skill	2							2		
	Total	26	0	0	0	0	13	5	8	0	

Course Code	Социка	Credita	Semester							
Course Coue	Course	creatis	1	2	3	4	5	6	7	8
KOMS120108	Tri Hita Karana	2	2							
	Total	2	2	0	0	0	0	0	0	0

Mata Kuliah Penciri Institusi (MKPI) or Educational Science Courses

Semester					Co	urses					Total Credits
I	Pancasila (2 credits)	Indonesian (2 credits)	<i>Tri Hita Karana</i> (2 credits)	Basic Mathematic (3 credits)	Algorithms and Programming (3 credits)	Digital System (3 credits)	Introduction to Information Technology (3 credits)	Human Computer Interaction (3 credits)			21
п	Civic Education (2 credits)	English (2 credits)	Religi (2 credits)	Calculus (3 credits)	Data Structures and Algorithms (3 credits)	Computer Architecture and Organization (3 credits)	Database (3 credits)	Data Communicatio n (3 credits)	Algorithm and Programming Lab (1 credit)	Database Lab (1 credit)	23
ш	Linear Algebra (3 credits)	Object- Oriented Programming (3 credits)	Statistics (3 credits)	Discrete Mathematics (3 credits)	Numerical Method (3 credits)	Web Technology (3 credits)	Computer Network (3 credits)	Computers and Society (2 credits)	Computer Network Lab (1 credit)		24
IV	Operating System (3 credits)	Research Methodology (3 credits)	Algorithm Analysis and Design (3 credits)	Artificial Intelligence (3 credits)	Distributed System (3 credits)	Software Engineering (3 credits)	Data Science (3 credits)	Object- Oriented Design and Analysis (3 credits)			24
V	Elective Course 1 (3 credits)	Elective Course 2 (3 credits)	Interdiscipline Course 1 (3 credits)	Interdiscipline Course 2 (3 credits)	Interdiscipline Course 3 (3 credits)	Community Engagement (4 credits)					19
VI	Elective Course 3 (3 credits)	Elective Course 4 (3 credits)	Elective Course 5 (3 credits)	Capita Selecta (3 credits)	English Communicatio n (2 credits)		Fieldwork (14 credits)				14 ¹
VII	Elective Course 6 (3 credits)	Elective Course 7 (3 credits)	Technopreneur (2 credits)	Professional Ethics (2 credits)	English Information Technology (2 credits)	Interpersonal Skill (2 credits)	Fieldwork (14 credits)				14 ¹
VIII	Thesis (6 credits)										6

Legends:

MKWU MKIK MKBS MKIP MKPI

Notes:

¹Students can take courses or a fieldwork (the MBKM program) as many as 14 credits in semester 6 or 7.

The following table is the courses descriptions:

No	Courses	Description
1	Basic Math	The Basic Mathematics course is a compulsory subject that provides students with an understanding of the basics of computer logic. This course is the basis of more advanced courses that are related to the understanding of math. The materials studied in this course are Sets, Relations & Functions, Mathematical Logic, Simple Probability, Matrices, Geometric Transformations, and Rows & Series.
2	Algorithms and Programming	This course contains the basics of structured programming and algorithms. Students are introduced to computer programming basic, how the compiler works, the basic structure of computer programmes, data types and variables, input and output, operations and techniques in programming which consist of arithmetic operations, logical operations, and bitwise operations, string operations, branching, looping, pointers, arrays, record/struct, functions, parameter passing, recursion, file operations, and library file creation.
3	Digital System	This course is a compulsory computer science course. The materials covered in this course is the basic principles of digital systems such as number systems (binary, octal, hexadecimal), Boolean algebra, logic gates (Logic Gate), simplification of logic circuits (Karnaugh map), combinational circuits (binary comparators and adders), flip-flops, flop (bistable), counter, register, decoder/demultiplexer and multiplexer as well as various digital circuit applications.
4	Introduction to Information Technology	This course discusses the history of digital computers and information technology, including developing ideas from the inventors and developers of computer machines and information technology. This course also discusses various devices and their working systems, introduction to operating systems, file and folder operations, utilities, modes, basic concepts of computer systems, input, process, output and storage devices, number systems, and multimedia technology. Students who complete the course will have demonstrated the ability to recognize and understand the concepts of information technology, its components, and the application of information technology in the field of life, which is closely related to computer science.
5	Human Computer Interaction	This course discusses designing an interactive computer system based on the basic concepts of human-computer interaction and the interaction model. In more detail through this course, students will learn and apply the techniques of assessing need, analyzing tasks and usability testing of a computer application, and learning and applying user interface management techniques, including tools for interface software development. So that students understand human cognition, human memory, problem-solving, language, and what and how these things relate in designing and developing interactive systems.

No	Courses	Description
6	Pancasila	This course is intended to shape students to demonstrate the principles of Pancasila and become a person who are spiritual in spirit, possess and uphold human dignity, have a high sense of nationality and love for the homeland.
7	Indonesian	Courses that shape students to have knowledge, skills, and be positive (loyal and proud) to use good Indonesian (according to the context) and correct (according to the rules), as well as polite, both oral and written for academic purposes and certain skills.
8	Tri Hita Karana	This course facilitates the development of students' personalities who are religious, ethical, tolerant and critical in responding to various social phenomena of society based on <i>Tri Hita Karana</i> (THK) or Three Causes to Prosperity through discussion topics regarding the historical perspective of THK, the meaning of welfare/happiness in THK, THK as a philosophy of life and local wisdom, THK as ethics. leadership, gender equality and THK, <i>Pancasila</i> and <i>Bhineka Tunggal Ika</i> .
9	Calculus	The Calculus course is a compulsory subject that provides students with an understanding of calculus material. This course is the basis for several other courses related to computer science. The materials studied in this course are limits, derivatives, anti-derivatives, and their applications
10	Data Structure and Algorithms	The data structure course provides an understanding of systematic ways to organize data to be used efficiently. An understanding of data structures is required for any computer system to be reliable in terms of three characteristics: correctness, time-complexity, and space-complexity. Along with the increasing number of computing applications, problems related to data structures arise. These problems include (1) search data, (2) processor speed, and (3) multiple requests or simultaneous access. This course covers the analysis and design of fundamental data structures to design algorithmically efficient and effective computer programmes to address the complexities of actual problems. This course focuses on data structures, array-based lists, linked lists, skip lists, hash tables, recursion systems, binary trees, stacks, sorting algorithms, and graphs.
11	Computer Architecture and Organization	This course discusses a general description of a computer system and then proceeds with a detailed discussion of the memory and I/O sections. Also discussed are operating system support and computer arithmetic. The material that will be given consists of 2 major parts: architecture and computer organization. From the point of view of the architecture of a computer, the material discussed in the lecture includes instruction sets, how to represent various data types, I/O mechanisms, and techniques for memory addressing. Meanwhile, from the organization of a computer's point of view, the materials that need to be discussed include control signals, interfaces between computer and peripherals, and the memory technology used.

No	Courses	Description
12	Database	Database courses learn basic techniques in building databases. The database studied in this course is a relational database. In this course, several concepts are given about databases, database management systems, database systems. Several techniques in database design are also given, such as database design using Entity-Relationship Diagram (ERD). Database Design in the form of Conceptual Data Model (CDM) and Physical Data Model (PDM) using applications. Transforming ERD into Relational Database. Perform database normalization to solve data anomaly problems (1NF-BCNF).
13	Data Communication	This course studies media and the mechanism of transmitting and receiving digital data. The materials discussed in this course include Layers 1 and 2 of the OSI Model. The first layer material of the OSI model includes transmission media, communication channels, channel coding, bit synchronization, multiplexing, and channel models. The second layer of OSI Model material includes Media Access Control (MAC), framing, error detection, and flow control.
14	Algorithm and Programming Lab	This course is a lab work course. Students are required to do a lab activity based on the given modules. The lab activities are designed to apply the theories obtained in the Algorithm and Programming course in an integrated manner based on cases. The theories applied to the lab work include the basic structure of computer programs, data types and variables, input and output, operations in programming consisting of arithmetic operations, logical operations, and bitwise operations, string operations, branching, looping, pointers, array, record/struct, function, parameter passing, recursion, file operation, and library file creation. These theories are designed to fit into the lab work module and form a case. The prerequisite of this course is to pass the Algorithm and Programming course.
15	Database Lab	This course is designed to ensure the students are able to create and maintain databases. The database used in the practice is MySQL or MariaDB database management system (DBMS). This course provides materials about techniques such as Data Definition Language such as Create, Alter, and Drop. Techniques of Data Manipulation Language (Insert, Update, Delete), JOIN, Subquery, View, Stored Procedure, Function, and Triggers are also given in this course.
16	Civic Education	This course provides a learning experience to increase understanding and awareness of a sense of nationality and love for the homeland, civilized democracy, how to become a citizen who has Indonesian personality, discipline, and actively participates in building a peaceful life based on the Pancasila. After taking this course students are able to demonstrate themselves as good citizens who are able to support the nation and state, become democratic citizens, namely citizens who are intelligent, civilized, and responsible for the survival of the Indonesian state in practicing science, technology, and art.

No	Courses	Description
17	English	The English course discusses the basic concepts of speaking English. According to the General English and English For Academic guidelines, students will learn four basic English concepts: listening, speaking/presentation, reading, and writing skills. In this course, students apply the basic concepts of the language to express their ideas and thoughts orally and in writing in academic life.
18	Hinduism	The Hinduism Course aims to facilitate students to demonstrate theoretical and practical understanding and implement Hindu religious concepts in individual, family, community life, both in the worldly and spiritual dimensions. To achieve this goal, the study materials include: (1) God Almighty, with details of the sub-materials <i>Sraddha</i> and <i>Bhakti</i> , <i>Brahmawidhya</i> , and efforts and means to worship God, (2) Humans, with details of the sub-materials of Hindu human conception, the nature of Hindu humans, Hindus dignity, Hindus responsibilities, and avatars and holy people, (3) Ethics, with the sub-study of the mission to improve oneself towards the ideal human (<i>manava-madhava</i>), (4) Science and technology, with the sub- study of <i>sraddha</i> , <i>janana</i> , and <i>karma</i> as a unity in <i>yadnya</i> , the obligation to study and practice it, <i>Tri Hita Karana</i> and responsibility to nature and the environment, (5) Harmony of religious life, with sub-religious material is a blessing for all, the essence of togetherness in religious plurality, (6) Society, with sub-study on the role of Hindus in realizing a prosperous Indonesian society, Responsibility of Hindus in realizing human rights and democracy, (7) Culture as Express The Practice of Hindu Teachings, with the sub-study of the relationship of religion as the core of culture and its various aspects, the responsibility of Hindus in realizing a critical (academic) way of thinking, working hard, and being fair, (8) Politics According to the Hindu Perspective, with sub-study understanding and sources of Hindu teachings on politics (<i>Nitisastra</i>), the contribution of Hinduism in the political life of the nation and state, (9) Law in the framework of upholding justice, with sub studies to grow awareness to obey God's law (<i>RTA/Dharma</i>), The role of Hinduism in the formulation and fair law enforcement, Hinduism's prophetic function in law.
19	Islam	This course is a personality development course, as a supporting subject in the study programme/department curriculum. The nature of this course carries the basic theory of personality direction that complements the readiness of students to build behavior based on religious, moral values. As a basic personality development course, this course requires practical actions in activities that are expected to reinforce developing a basic personality in carrying out tasks in other subjects.
20	Catholic Christianity	Catholic Christianity at public universities allows Catholic students to have: faith and piety to God Almighty, broad and adequate knowledge that helps develop prospective scholars who are religious, fear God, have a noble character, are philosophical, are rational and dynamic, appreciate the cooperation between religious communities in devoting science, technology, and art for the national interest.
21	Protestant Christianity	Protestant Christianity aims to shape the character of students who are Protestant Christians who have: faith and piety to God Almighty, broad and adequate knowledge that helps develop prospective scholars who are

No	Courses	Description
		religious, fear God, have a noble character, have a philosophical mind, are rational and dynamic, respecting inter-religious cooperation in devoting science, technology, and art for the national interest.
22	Buddhism	Buddhism course provides understanding and enlightenment to students to develop a prominent and noble personality based on the basic values of Buddhist teachings in individuals, families, communities, states, and nations and apply science and technology responsibly supported by understanding and practicing the concept of divinity. Humanity, ethics, culture, law, and politics.
23	Confucianism	This material discusses the importance of religion in everyday life with the right attitude, understanding of the sources of Confucian law, knowing the history of Confucianism, being able to explain the Holy Way brought by the Great Teaching (Thai Hak), able to explain about "examining the essence of each case," knowing the role of Confucius in the development of science and technology.
24	Linear Algebra	Linear Algebra is a compulsory subject. The material discussed includes the study of spanning sets, linear and base independent, dimensions, direct sums, coordinates, and ordered bases, linear mapping in vector spaces, linear mapping, and matrix algebra, base changes, rank, determinant and inverse, echelon form of a matrix, eigenvectors and eigenvalues, matrix diagonalization, orthogonality, general inverse.
25	Object-Oriented Programming	This course discusses the object-oriented programming paradigm. The material studied in this course is the basic concepts of object-oriented programming (OOP), such as class-object, encapsulation, inheritance, polymorphism, interfaces, abstract classes. Specifically, these concepts will be studied with the help of the Java programming language. In addition to the basic concepts of OOP, this course will also study the concept of exception handling.
26	Statistics	This course will provide knowledge about the meaning of statistics, statistical classification, measurement scales, descriptive statistics, research hypotheses, parametric statistics, non-parametric statistics
27	Discrete Mathematic	This course is a mandatory course for Computer Science students. The materials studied in this course are an introduction to logic, sets, relations and functions, mathematical induction, algorithms and integers, graphs, trees.
28	Numerical Method	This course is mandatory for Computer Science students. The materials studied in this course are Taylor series and error analysis, solutions of nonlinear equations, solutions of linear equations, interpolation, numerical integration, regression of numerical derivatives, and solutions of ordinary differential equations.
29	Web Technology	This course provides an understanding and ability to implement programming concerning the development of web-based applications and their development environment. The material given in this lecture includes server-side and client- side programming, system interoperability, and service-oriented system architecture. So that students can develop interactive website-based applications using the latest web development technology.

No	Courses	Description
30	Computer Network	This course studies the basics of computer networks, with the learning structure following the OSI model. The materials discussed in this course include a review of Layer 1 OSI Model material, a review of Layer 2 OSI Model material, Layer 3 OSI Model consisting of network topology, Addressing, ICMP, Subnetting, Routing, and NAT, Layer 4 Model OSI with emphasis on socket programming, and introduction to Layers 5, 6, and 7 of the OSI Model. The material in this course is more focused on Layers 3 and 4 of the OSI Model. Layers 1 and 2 of the OSI Model are discussed further in the Data Communication course. To take this course, students must have taken a Data Communication course.
31	Computers and Society	This course discusses the utilisation of computers in society, in various fields such as business, education, government, industry, and healthcare.
32	Computer Network Lab	The course is designed to apply the theories obtained in the Computer Networking course in an integrated manner based on the given cases. The theories applied in the lab activity include the network topologies, IP addressing, various protocols, subnetting, routing, and socket programming. The prerequisite of this course is to pass the Data Communication course and at least take the Computer Networking course.
33	Operating System	This course gives basic concepts and introduction to operating systems on computers, memory management, scheduling methods, and installation of several popular operating systems as well as making documentation about the installation.
34	Research Methodology	This course will provide knowledge about the concepts of science and research, types of research, problems and problem formulation, literature review, research methods and design, operationalization of research variables, sources and types of data, data collection techniques and tools, validity, and reliability of data collection tools. Population and sampling techniques, data analysis techniques, research proposal preparation, presentation techniques, and exercises.
35	Algorithm Analysis and Design	This course studies various algorithms, analyzing algorithms, and designing algorithms. The materials discussed in this course include complexity theory, algorithm design strategy, calculation of algorithm complexity, sorting algorithm, searching algorithm, and graph algorithms. To take this course, students must have passed the Discrete Mathematics course.
36	Artificial Intelligent	This course is a computer science course that studies how to make machines, in this case, computers, to do a task as humans do, even better than humans. This course discusses various techniques and methods of machine intelligence and their disadvantages, advantages, and applications. Through this course, students are expected to provide alternative solutions to problems in the real world intelligently. The study materials in this course include the concept of intelligent agents, problem-solving with search methods, knowledge and reasoning, planning, and uncertain knowledge and reasoning.
37	Distributed System	This course discusses the basic knowledge of the characteristics of Distributed Systems, Distributed System modeling, Networking and Internetworking concepts, Interprocess Communication, Remote Invocation, Indirect

No	Courses	Description
		Communication, Operating System Support, Timing Systems, and Global Status can create documentation about its installation.
38	Software Engineering	Software Engineering course introduces students the ways of developing software from creation, maintenance, organizational management of software development and quality management
39	Data Science	This course introduces data science and provides its real world implementation. The material given in this course is the stage of data science and examples of their applications, introduction to data sources, big data, data attributes, and data descriptions, data visualization practices using tools. Data preprocessing techniques (including lab work) such as handling missing values, correlation analysis for feature selection, sampling, and normalization are the subjects of this course. This course also covers the introduction of several techniques, namely descriptive analysis using statistics, simple data visualization (including lab work), machine learning methods, application examples, predictive analysis techniques such as pattern mining, regression, classification, and their application examples.
40	Object-Oriented Design and Analysis	Object-Oriented Analysis and Design course introduces students to the system analysis and design using object-oriented methods.
41	Service-Oriented Architecture*	This course explores concepts, principles, and state-of-the-art methods in enterprise architecture, including architectural styles, architectural description languages (ADL), software connectors, dynamism in architecture, and architecture-based testing and analysis. At the end of the course, students are expected to understand the concept of Service-Based Architecture and can design applications by integrating existing services.
42	Mobile Application Development*	This course discusses the basic concepts and techniques of mobile programming, especially on Android application programming. The material studied in this course is the concept of mobile programming architecture, application interfaces, android programming construction, basic android programming, and mobile API programming. The learning objectives of this course are that students can apply the basic concepts of OOP in developing Android-based applications with an easy-to-use interface; students can implement Android Run-time settings and Application Programming Interface (API); students can perform debugging and bug analysis processes; and students can implement multimedia data into Android applications. Students are expected to design mobile based applications with a good user experience that are efficient and productive.
43	Information Retrieval**	The materials covered in this course are the introduction to information retrieval and the basics of information retrieval: modeling, evaluation, querying, text and multimedia operations, indexing, and searching. Specific topics covered include relevance feedback, query expansion, text classification, text clustering, summarization, cross-language, question answering, web search. Students are expected to explain concepts in information retrieval and apply them in the lab work of making text information retrieval systems.
44	Data Mining**	This course introduces students to data mining techniques. Based on the data

No	Courses	Description
		obtained, an analysis was carried out to determine the patterns that occurred on the data. The material given in this course is data introduction, data exploration, classification, association, clustering, and data mining trends.
45	Inter-Network Technology***	This course aims to give proper attitudes, knowledge and skills, and understanding of how computers communicate and how data can be delivered between TCP/IP Layers devices. Topics include but are not limited to introduction to internetworking technology, IP Addressing, Subnetting, Switching, Virtual LAN, Spanning Tree Protocol (STP), DHCP4, Concept of LAN Security, WLAN, Routing, and Introduction to Datacenter and distributed systems.
46	Information Security***	In this course, students are introduced to the concept and application of Information Security, such as the history of applying security encryption and not limited to the application of Information Security aspects: wireless security, internet protocol security, intrusion detection systems, ad hoc networking.
47	Interdisciplinary Course 1	Interdisciplinary Course provides opportunities for students to explore other fields of science outside the field of computer science that can be taken in other study programmes.
48	Interdisciplinary Course 2	Interdisciplinary Course provides opportunities for students to explore other fields of science outside the field of computer science that can be taken in other study programmes.
49	Interdisciplinary Course 3	Interdisciplinary Course provides opportunities for students to explore other fields of science outside the field of computer science that can be taken in other study programmes.
50	Community Engagement	<i>Kuliah Kerja Nyata</i> (KKN) or Community Engagement is an activity and fieldwork that integrates education and teaching to the community, research, and community service by students pragmatically in a short time, with broad dimensions through an interdisciplinary, comprehensive, and cross-sectoral approach to provide a real experience to students in applying their knowledge.
51	Capita Selecta	This course discusses the latest research topics in Computer Science which can be used as references for students to work on Proposals/Thesis. In general, the topics discussed are presented in seminars presented by several resource persons, namely lecturers who are involved in research groups and those with doctorate degrees or speakers who are specifically invited to give public lectures related to technological developments that are becoming a current trend.
52	English Communication	The material in this course is structured to develop students' English skills in several skills, namely reading, writing, structure, and speaking. The focus is on helping students master English as a general international language and convey ideas and ideas in technology-related fields. Students are given knowledge and practice of speaking in English and can read and write scientific articles in more depth about the English language structure, especially in the field of Computer Science.
53	Software Testing*	Software Testing discusses testing methods, documentation, and software maintenance.

No	Courses	Description
54	Software Project Management*	This course provides basic concepts, knowledge, and skills in software project management, including planning, organizing, directing, and controlling to create software for organizational resources owned by the organization. This course also provides insight and ability in anticipating organizational change, especially those related to software projects in the community.
55	Creative Technology Development*	This course teaches designing a model and implementing it through technology assistance which has important elements, namely creativity, and innovation, to help society in the industrial era 4.0. The development of this technology can be in software, multimedia, games, IoT (Internet of Things), which combines reason, art, and creativity from the developers.
56	Expert System**	The expert system course aims to understand computer systems that utilize artificial intelligence methods to solve a problem in a specific domain that usually requires someone's expertise. To produce the desired intelligence (expert), an expert system relies on two components, namely a knowledge base and an inference engine. The facts for the knowledge base must be obtained from human experts through interviews and observations. This knowledge is represented in an "if-then" production rule format. The probability factor can also be included in the production rules to the final recommendation because the conclusion is not a certainty. Based on facts and production rules, conclusions or final recommendations are inferred (reasoned). An inference engine carries out the process.
57	Digital Image Processing**	This course studies algorithms for processing digital images to obtain digital image results for processing. The materials discussed in this course include the basic concepts of digital imagery, intensity transformation, spatial domain filters, frequency domain filters, image restoration and reconstruction, color processing, morphing, image segmentation, and image representation and description.
58	Pattern Recognition**	The pattern recognition course discusses the recognition of patterns and regularity in data. This course aims to enable students to identify and analyze the data regularly. Students will learn how to extract meaningful information from data features in this course. This course involves statistical and information theory concepts related to machine learning, data mining, and pattern recognition.
59	Internet of Things (IoT)***	This course provides learning on applying the knowledge gained in computer networking and organization courses to solve real-world problems and make IoT designs from network devices and computers that match the problem. The materials given in this course are the concept of machine to machine, wireless sensor network, Internet of things, Network Programming, IoT Platform, IoT Hardware, Middleware, Web Service, and IoT Design.
60	Cyber Security***	This course aims to understand the notion of security, system understanding and system security, evaluation of system security, securing information systems, email security, web security, system security exploitation, encryption decryption, cryptography, steganography, etc firewalls, cyber law, and system security. Wireless.
61	Parallel Computing***	This course discusses how to solve large-scale computational problems quickly by utilizing parallel computing. These problems are usually expressed

No	Courses	Description
		as large data sets stored in multi-dimensional data. Furthermore, these problems can usually be partitioned across multiple processors to achieve large-scale parallelism. This course will study the forms of parallelization in various application domains and the hardware needed to support parallel execution.
62	Technopreneur	Technopreneur is a continuation course of entrepreneurship that develops skills in terms of technology. This course develops a Business/Startup that combines complex skills that help people in their daily lives. This course must be included in the curriculum to give students the freedom to be creative and develop their skills in determining ideas, realizing ideas, and maintaining business to survive.
63	Professional Ethics	The Professional Ethics course will discuss human norms or rules in carrying out their profession or work to consider all their actions in carrying out their work, especially in the field of computer science. The purpose of this course is for students to understand ethical issues related to the use of ICT. Through this course, students are expected to analyze and use good judgment and intuition to help deal with various problems related to ethics and computing.
64	English for Information Technology	This course develops self-competence, especially effective oral and written communication skills in English, specifically related to Information Technology. Students are assumed to have basic English acquired in English courses in this course. Students will learn about technical terms in the IT world (computer systems, websites, databases, e-commerce, IT support, network systems, IT security, and technology). In addition, students will learn how to make a correct IT application letter in English, do job interviews in good English, and communicate in English for work purposes in the dynamics of the global IT industry.
65	Interpersonal Skill	The interpersonal skills course will discuss how students develop the ability to communicate effectively and build relationships with others. The study materials covered in this course include: how to listen and give good feedback; problem-solving; effective negotiations; emotional intelligence; leadership; presentation and public speaking techniques; self and time management. After attending this course, students are expected to be able to develop soft skills related to communication skills in the world of work, behave, and behave according to the ethics and norms prevailing in society, work independently or work in teams, be able to think logically and analytically, and can communicate both verbally. As well as writing.
66	Geographic Information System*	<i>Sistem Informasi Geografis</i> (SIG) or Geographic Information System consists of software or software, hardware, storing, analyzing, collecting geographic data, and developing it into information in the form of mapping, certain symbols, maps to help the community.
67	Enterprise Architecture*	In this course, students will learn the enterprise architecture framework, namely the design of alignment between business, information systems, and technology aspects in a company to achieve its goals.
68	Robotics**	The course discusses the basic concepts of robotics, mechanical analysis, planning, and the structure of the degree of freedom in a robot application. In particular, the material also covers servo, image processing, embedded

No	Courses	Description
		systems for robotics so that students understand how mobile robot applications work with wheels, legs, humanoids, and aerial robots.
69	Decision Support System**	<i>Sistem Pendukung Keputusan</i> (SPK) or Decision support system (DSS) is part of a computer-based information system (including a knowledge-based system (knowledge management) that is used to support decision making at the management level for an organization or company. A computer system that processes data into information for making decisions on semi-structured problems) or unstructured DSS is used to support ad hoc data analysis and decision modeling, decision-oriented, future planning orientation, and is used in unusual times such as selecting employees, determining locations, determining new covers, and determining scholarship awards.
70	Data Center Architecture***	This course covers the basic principles of data center design, the early history of mainframes to modern data centers in their various forms and eras. The material specifically addresses all the major subsystems of a data center critical facility and their integration, including resource systems, cooling, computing, and networking. Students will learn to apply recommended best practices in site selection, building layout requirements, including durability and space requirements, and understand relevant standards, regulations, definitions, and metrics that apply to building the data center industry.
71	Cloud Computing***	In this course, students will learn the basics of cloud computing technology, its architecture, mechanisms, how it works, and the latest related research. In general, the following material will discuss infrastructure, understanding related to network technology, data storage systems, security systems, how to carry out maintenance and monitoring of cloud computing-based systems regularly, financing and techniques for selecting the right service according to the needs and concepts in migrating from conventional systems. Students will be introduced to today's popular cloud computing technologies such as Google Cloud Platform, Microsoft Azure, and Amazon Web Services (AWS). The study programme has collaborated with AWS to adapt learning materials to the AWS Cloud Practitioner module. In practical activities, students will try laboratory exercises directly using temporary Cloud Instances provided by AWS.
72	Thesis	This course is a mandatory scientific work in the form of a final report to graduate in the computer science study programme. This final report is the result of research in the field of computer science as a form of accumulation of student competence in the computer science study programme.