ANNEX 1

Curriculum Document of

INFORMATICS EDUCATION STUDY PROGRAMME (BACHELOR DEGREE)

FACULTY OF ENGINEERING AND VOCATIONAL

Universitas Pendidikan Ganesha
2021

A. IDENTITY

1	Name of Study Programme, Level	Informatics Education, Bachelor Degree
2	Address	Jl. Udayana no. 11 Singaraja, 81116
3	Regency/City	Singaraja
4	Postal code	81116
5	Phone number	(+62362) 27213
6	Fax Number	(+62362) 27213
7	Email address	pti@undiksha.ac.id
8	Website address	https://pti.undiksha.ac.id
9	Degree given	Bachelor of Education (S.Pd.)
10	Year and Decree of Establishment	The Decree of the Director-General of Higher Education Number 2090/D/T/2007
11	Year and Decree of Accreditation	The Decree of the BAN-PT Number 6038/SK/BAN-PT/Akred/S/IX/2020

B. LEADERSHIP OF THE STUDY PROGRAMME

1	Name	Gede Saindra Santyadiputra,S.T.,M.Cs
2	Position	Coordinator of the Study Programme
3	Decree of Assignment	2831/UN48/KP/2019
4	Assignment start date	November 23, 2019
5	Assignment complete date	November 23, 2023

A. RATIONALE

The Pendidikan Teknologi Informatika (PTI) or also known as Informatics Education Study Programme (IESP) curriculum development is institutionally organized by LPPPM UNDIKSHA or *Lembaga Pengembangan Pembelajaran dan Penjaminan Mutu* (Learning Development and Quality Assurance Institute). The curriculum development of the IESP refers to policies and the role of stakeholders both internally and externally. The curriculum of the IESP refers to the Regulation of the Minister of Research and Higher Education Number 44/2015 concerning National Higher Education Standards, Law Number 12 of 2012 concerning KKNI or *Kerangka Kualifikasi Nasional Nasional* (the Indonesian National Qualifications Framework), the Guide Documents for Preparation of Higher Education Curriculum in Era 4.0 and Guide Documents for Preparation Independent Learning Curriculum Independent Campus, 2020 Computing Curricula Document, and KKNI Curriculum Development Document Based on OBE in Informatics and Computer Science 2020.

B. DESCRIPTION OF STUDY PROGRAMME PROFILE

In line with the current development, the time to welcome the third millennium, a new era with more severe and complex challenges, The Department of Information and Computer Technology Education is here as an answer to the commitment of UNDIKSHA to participate in advancing and developing information technology and computer education in Indonesia in general, and Bali in particular.

Starting in 1998, the Ministry of National Education has issued a policy whereby LPTK or *Lembaga Pendidikan Tenaga Kependidikan* (Institute of Teachers' Education) has been given the authority to implement non-educational programmes as outlined in the policy to expand the mandate. With the Decree of the Director-General of Bachelor Programme in Higher Education Number: 2090/D/T/2007, UNDIKSHA opened the Bachelor Programme in Information Technology and Education.

The Department of Information and Computer Technology Education for the Academic Year of 2007/2008 is the first batch of new student admissions. The Department of Information Technology and Computer Education is under the Faculty of Engineering and Vocational, UNDIKSHA, Singaraja Bali. The Department of Information and Computer Technology Education was officially opened in 2007, with the department's anniversary being commemorated every September 9th. The Credit Transfer

Programme for Diploma Programme in Informatics Management graduates, continuing to the Bachelor Programme, was opened a year later.

Based on SK DIKTI (Decree of the Directorate General of Higher Education) No. 163/DIKTI/Kep/200, and Decree of the Chancellor of UNDIKSHA No. 257/H48/PP/2009, the Department of Information Technology and Computer Education officially changed its name to the Department of Information Engineering Education. Furthermore, since 2019, this department has become a Study Programme under the Department of Informatics Engineering.

C. VISION AND MISSION

The vision of the Informatics Education Study Programme

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

The mission of the Informatics Education Study Programme

The missions of IESP are:

1. Organizing education to produce graduates of Informatics Education who are professional and superior (competitive, collaborative, and characterized) based on the *Tri Hita Karana* philosophy.
2. Researching the development of Informatics Education science and the field of informatics science to support the achievement of graduate competencies, the achievement of the vision of study programmes, faculties, universities, and national education goals.
3. Carrying out community service in the context of implementing, socializing, and disseminating information technology education and informatics science by the development of society, science, art, and technology, as well as establishing partnerships with other institutions both domestically and abroad.

D. OBJECTIVES

The objectives of the Informatics Education Study Programme are:

1. Produce graduates who have pedagogical, professional, social, and personal competencies as subject teachers in informatics science based on the *Tri Hita Karana* philosophy so that graduates can carry out their duties professionally.

2. Produce graduates who mastered informatics science in contributing to the achievement of national education goals, national development, and community development.
3. Produce innovative research, implement the theory, and develop products in testing theory in education and learning in informatics engineering and informatics science.
4. Dissemination of innovative research results to the community in community service activities and collaboration with domestic and foreign agencies.

E. PROFILE OF GRADUATE

Profile of Graduate	Description
The Prospective Computer and Informatics Engineering Educator	As Prospective educators (teachers/teachers/instructors/trainers) who have superior competence in the fields of education, informatics science, and information technology education (competitive, collaborative, characterized) based on the *Tri Hita Karana* philosophy

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 *Tri Hita Karana* values.
2. KNOWLEDGE	
PLO2	Mastering the concepts of education, informatics science, and informatics engineering education in general
PLO3	Mastering the learning theory and content of informatics engineering in depth, which includes the curriculum of informatics engineering, learning methodologies, media, and technology, as well as evaluation according to the characteristics of the material (content knowledge) of informatics engineering
PLO4	Mastering research and development theory to improve the quality of informatics engineering education in schools.
3. GENERAL SKILLS	

PLO5	Able to integrate learning and innovation skills, mastery of technology and information, career development, and life skills to become lifelong learners.
PLO6	Able to apply logical, critical, systematic, and innovative thinking to develop or implement science and technology that pays attention to and applies humanities values following their field of expertise.
4. SPECIAL SKILLS	
PLO7	Able to plan, implement, and evaluate/assess information technology learning by utilizing various science and ICT-based learning resources.
PLO8	Designing learning systems/models, producing learning media, utilizing learning media, controlling learning systems/models, and evaluating the application of informatics engineering learning systems/models.
PLO9	Applying, studying, designing, utilizing science and technology, and solving problems in informatics engineering education.

G. LEARNING PROCESS

The implementation of UNDIKSHA's Curriculum is based on the principles of interactive, holistic, integrative, scientific, contextual, thematic, effective, collaborative, and student-centered learning (SNPT or *Standar Nasional Perguruan Tinggi* (National Higher Education Standards), Number 44 of 2015).

1. Interactive learning is a learning process that prioritizes a multi-way interaction process.
2. Holistic learning is a learning process that encourages the formation of a broad mindset by internalizing local, national, and global excellence and wisdom.
3. Integrative learning is a learning process integrated into one programme unit through an interdisciplinary and multidisciplinary approach.
4. Scientific learning is a learning process that prioritizes a scientific approach to create an academic environment based on a system of values, norms, and scientific principles and upholds religious and national values.
5. Contextual learning is a learning process adapted to the demands of problem-solving skills in the realm of expertise.
6. Thematic learning is adapted to the study program's scientific characteristics and is linked to real problems through a transdisciplinary approach.

7. Effective learning is a learning process directed at achieving graduate learning outcomes effectively by prioritizing the internalization of the material properly and correctly in an optimal period.
8. Collaborative learning is a learning process that involves Interaction between individual learners to produce attitudes, knowledge, and skills in an integrated manner
9. Student-centered learning is a learning process that prioritizes the development of creativity, capacity, personality, and student needs and develops independence in seeking and discovering knowledge, skills, and attitudes.

The learning process in each subject can use one or more approaches, models, strategies, and learning methods that are in accordance with the characteristics of the subject matter to facilitate the fulfillment of 21st Century Capacity-oriented graduate learning outcomes (SNPT Number 44 of 2015).

The teaching and learning process is related to providing quality learning experiences for students. Monitoring of learning progress and the achievement of student learning outcomes is needed to (a) assess the suitability of the educational process with the curriculum used, (b) identify problems that need to be addressed, (c) improve the learning process, (d) assess the success of lecturers in carrying out assignments, and (e) measuring students' abilities.

The study programme's teaching and learning process is in accordance with the Ministry of Research, Technology, and Higher Education standards, which consists of lesson planning, lecturer and student attendance rates, evaluation of the implementation of learning and learning processes, and learning outcomes. The latest Semester Lesson Plans complement this course. Each course is equipped with a textbook/handout/lecture notes.

The attendance rate of lecturers for one semester is monitored at least 85%, and students attend 75% of lectures in 16 meetings as a minimum requirement to take the exam. The Study Programme encourages lecturers to apply student-centered teaching and learning methods (learner-oriented) and problem-based learning. The application of an active learning model with several techniques, namely discussion methods, case studies, role-playing, and problem-based. The role of the lecturer is

more as a facilitator in the learning process. Lecturers are facilitators in one's learning process in gaining competence. The following is a learning experience that students will obtain.

Course Learning Outcome	Code of CLO	Learning experiences
• Demonstrate religious attitudes in the nation and state. • Integrate and apply lifelong learning based on humanities values and *Tri Hita Karana* philosophy	CLO1	Face-to-face, group discussion, presentation.
• Demonstrate scientific attitudes and behavior based on norms and ethics based on *Tri Hita Karana* philosophy. • Apply the principles of *Tri Hita Karana* philosophy in daily life.	CLO2	Face-to-face, group discussion, presentation.
• Master theoretical concepts in the field of pedagogy. • Master learning theory and practicing scientific supporting content of the teaching profession in learning. • Integrate and apply learning skills and mastery of information technology in learning. • Using informatics technology, planning, designing, producing, implementing, controlling, and evaluating information technology learning.	CLO3	Face-to-face, group discussion, presentation, individual project, group project.
• Master theoretical concepts in the field of informatics science. • Practicing learning with informatics scientific content. • Mastering and applying research theory to improve the quality of informatics learning in schools. • Integrating and applying learning skills and the use of technology that can help the learning process. • Applying, reviewing, and making designs for solving problems in information technology education.	CLO4	Face-to-face, group discussion, presentation, individual project, group project.

H. ASSESSMENT

The final assessment process in the Informatics Engineering Study Programme refers to the Study Guidebook owned by the Universitas Pendidikan Ganesha. Assessment of student learning outcomes cannot be assessed if face-to-face lectures and fieldwork results have not met the 75% target of 16 meetings and/or practicum has not been 100%. For this reason, the lecturer concerned is required to give additional lectures or practicum

and must have provided an evaluation before the deadline for submitting grades.

If these requirements have not been met, the lecturer must give additional lectures and/or practicum 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 in question. The value of the subject will be marked as E. The assessment reference for all courses uses PAP or *Penilaian Acuan Patokan* (Benchmark Reference Assessment), as seen in the following table.

Percentile Score	Scale Value	Letter Score
85 – 100	4,00	A
81 – 84	3,75	A-
77 –80	3,25	B+
73 – 76	3,00	B
69 – 72	2,75	B-
65 – 68	2.50	C+
61 – 64	2,00	C
40 – 60	1,00	D
0 – 39	0,00	E

In the administrative process, the creditable value is C and above. For the Bachelor 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 score 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, the minimum score for Religion and Pancasila courses is C, while the minimum value for PPL or *Praktik Pengalaman Lapangan* (Professional Placement) 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	Kinds of Assessment	Time
PEO1, PEO2, PEO3	• Employer satisfaction survey • Alumni Survey	Few years after graduation
PLO1, PLO2, PLO3, PLO4, PLO5, PLO6, PLO7, PLO8, PLO9	• Instructor evaluation report • Department/Study Programme Performance Report	Upon graduation

	• Student exit survey	
CLO1, CLO2, CLO3, CLO4	• Direct assessment • End of the course assessment • Semester performance report • Students report/comments	Upon course completion

I. CURRICULUM STRUCTURE

The curriculum of the Informatics Engineering Education Study Programme is prepared based on KKNI or *Kerangka Kualifikasi Nasional Indonesia* (the Indonesian National Qualifications Framework) level 6. The evaluation and updating of the curriculum is prepared based on several references from within the country and abroad and involves several stakeholders from internal and external parties. The main reference used is the Academic Paper of KKNI for the Informatics and Computer Sciences Group compiled by APTIKOM or *Asosiasi Pendidikan Tinggi Informatika dan Komputer* (the Association for Higher Education in Informatics and Computers). 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). IESP implements the Independent Learning Curriculum for MBKM or *Merdeka Belajar Kampus Merdeka* (Freedom to Learn - Independent Campus) of UNDIKSHA in 2020. MBKM is part of the Independent Learning policy by the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, which provides opportunities for students to hone skills according to their talents and interests by going directly into the world of work as preparation for future careers. Recognition in the MBKM programme is also stated in the curriculum, where students can take the MBKM programme in semesters 6 and 7. Recognition in the MBKM

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IESP divides the courses into four classifications, namely:

1. MKWU or *Kelompok Mata Kuliah Wajib Umum* (Compulsary Course)
2. MKIK or *Kelompok Mata Kuliah Inti Keilmuan* (Core Study Course)
    a. MKKK or *Mata Kuliah Keilmuan Kependidikan* (Educational Science Courses)
    b. MKBS or *Mata Kuliah Keilmuan Bidang Studi* (Scientific Field of Study Courses)
3. MKIP or *Kelompok Mata Kuliah Iptek Pendukung* (Supporting Science and Technology Courses)
4. MKPP/MKPI or *Kelompok Matakuliah Penciri Prodi/Institusi* (Study Programme Specific Courses)

The MKWU group is a group of study materials and lessons to develop Indonesian people who believe and are devoted to God Almighty and have a noble character, have strong and independent personalities, and have a sense of social and humanitarian responsibility. These courses must be offered and consist of Pancasila Education, Religion Education, Civic Education, Bahasa Indonesian, and English. The MKIK Group is a group of study materials and lessons shown primarily to provide a basis for mastering certain knowledge and skills following the knowledge developed by the study programme concerned. This group of subjects is divided into Educational Science Courses (MKKK) and Scientific Field of Study Courses (MKBS). The MKIP Group is a group of study materials and lessons that support the implementation of the core scientific study programmes that aim to produce experts or skilled workers, both offered by the Study Programme itself and across Study Programmes. Courses that characterize study programmes/institutions are courses that characterize institutions or faculties such as the *Tri Hita Karana* course and the Vocational Education course.

In addition to the courses described above, students can also take the MBKM programme, taking several programmes such as student exchanges, workfield, teaching in schools, independent research, humanitarian projects, entrepreneurial activities, independent studies, or village development programmes. This activity is recognized as equalizing credits in semesters 6 and 7.

The following is the distribution of the classification of courses at IESP:

Num.	Course Classifications	Credits

		Number of courses	SKS Load
1.	General Compulsory Courses (MKWU)	10	10
2.	Field of Study Courses (MKIK)	38	99
	a. Scientific Core Courses – Educational Science Courses (MKKK)	7	14
	b. Field of Study Courses (MKBS)	31	112
3.	Group of Supporting Science and Technology Courses (MKIP)	12	34
4.	Group of Courses that Characterize Study Programme/Institutions (MKPP/MKPI)	2	4
	Total	**62**	**147**

The following is the structure of the IESP curriculum by category:

General Compulsory Courses (MKWU)

Course Code	Course	Credits	Semester							
			1	2	3	4	5	6	7	8
TIKS120101	Indonesian Language	2	2							
TIKS120102	Pancasila	2	2							
TIKS120201	English Language	2		2						
TIKS120202	Hinduism*	2		2						
TIKS120203	Islam*	2		2						
TIKS120204	Catholic christianity *	2		2						
TIKS120205	Buddhism*	2		2						
TIKS120206	Protestant Christianity*	2		2						
TIKS120207	Confucianism *	2		2						
TIKS120208	Civic Education	2		2						
	Total	**20**	**4**	**16**						

Description:

*) Students choose one of 6 Religion courses.

Science Subject (MKIK)

Course Code	Course	Credits	Semester							
			1	2	3	4	5	6	7	8
TIKS120104	Educational Insight	2	2							
TIKS120105	Learners Development	2	2							
TIKS120106	Discrete Mathematics	3	3							
TIKS120107	Linear Algebra	2	2							
TIKS120108	Basic Computer System	3	3							
TIKS120109	Introduction to Computer Organization and Architecture	2	2							
TIKS120104	Educational Insight	2	2							
TIKS120209	Belajar dan Pembelajaran	2		2						
TIKS120210	Curriculum Study	2		2						
TIKS120212	Algorithms and Programming	3		3						
TIKS120213	Information Systems	3		3						
TIKS120214	Operating System	3		3						
TIKS120215	Database	3		3						
TIKS120301	Learning Strategy and Design	2			2					
TIKS120302	Instructional Assessment and Evaluation	2			2					
TIKS120305	Software engineering	3			3					
TIKS120306	Web Programming	3			3					
TIKS120307	Data Structures and Algorithm Analysis	3			3					
TIKS120308	Microprocessors and Basic Robotics	3			3					
TIKS120309	Object-Oriented Programming	3			3					
TIKS120401	Microteaching	2				2				
TIKS120403	Human Computer Interaction	2				2				
TIKS120405	Digital Image Processing	3				3				
TIKS120406	Artificial intelligence	3				3				
TIKS120407	Computer network	3				3				

TIKS120408	Mobile Programming	3				3				
TIKS120502	Network Security[1]	3					3			
TIKS120503	Network Administration[1]	3					3			
TIKS120504	Advanced Computer Network[1]	3					3			
TIKS120508	Advanced Mobile Programming[2]	3					3			
TIKS120509	Advanced Web Programming[2]	3					3			
TIKS120510	Advanced Database [2]	3					3			
TIKS120511	Advanced Image Processing[3]	3					3			
TIKS120512	Advanced Robotics[3]	3					3			
TIKS120513	Big Data[3]	3					3			
TIKS120601	Fieldwork 1	14						14		
TIKS120602	Proposal Seminar	0						0		
TIKS120701	Fieldwork 2	14							14	
TIKS120801	Thesis	6								6
	Total	**128**	**16**	**16**	**19**	**16**	**27**	**14**	**14**	**6**

Description:

Students choose packages between 1, 2, 3, or 4 (4 is in MKIP)

[1)] Computer and Network Engineering course package (Elective Course)

[2)] Software Engineering course package (Elective Course)

[3)] Smart Systems course package (Elective Course)

Supporting Science and Technology Courses (MKIP)

Course Code	Course	Credits	Semester							
			1	2	3	4	5	6	7	8
TIK20303	Statistics	2			2					
TIK20304	Learning Multimedia	3			3					
TIK20402	Entrepreneurship	2				2				
TIK20404	Research methodology	3				3				
TIK20409	2D Animation Basics	3				3				
TIK20501	Professional English	3					3			
N/A	Interdisciplinary Course 1	3					3			

N/A	Interdisciplinary Course 2	3					3			
N/A	Interdisciplinary Course 3	3					3			
TIK20505	Interactive Multimedia [4]	3					3			
TIK20506	Game Design[4]	3					3			
TIK20507	Advanced Computer Animation[4]	3					3			
	Total	**34**	**0**	**0**	**5**	**8**	**21**	**0**	**0**	**0**

Description:

Students choose packages between 1, 2, 3, or 4 . (1, 2, and 3 are in MKIK)

[4)] Multimedia course package (Elective Course)

Kelompok Matakuliah Penciri Prodi/Institusi (MKPP/MKPI)

Course Code	Course	Credits	Semester							
			1	2	3	4	5	6	7	8
TIK20103	*Tri Hita Karana*	2	2							
TIK20211	Vocational Education	2		2						
	Total	**4**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**

The following is a table of course distribution by semester:

Year 1		Year 2		Year 3		Year 4	
1st SEMESTER	2nd SEMESTER	3rd SEMESTER	4th SEMESTER	5th SEMESTER	6th SEMESTER	7th SEMESTER	8th SEMESTER
Indonesian Language (2)	English Language (2)	Instructional Design and Strategies (2)	Microteaching (2)	English for Professional Purposes (3)	Fieldwork 1 (14)	Fieldwork 2 (14)	Thesis (6)
Pancasila (2)	Religious Education (2)	Learning Evaluation and Assessment (2)	Entrepreneurship (2)	Interdiscipline Course 1 (3)	Proposal seminar (0)		
Tri Hita Karana (2)	Civic Education (2)	Statistics (2)	Research Methodology (3)	Interdiscipline Course 2 (3)			
Insight on Education (2)	Vocational Education (2)	Learning Multimedia (3)*	Basics of 2D Animation (3)	Interdiscipline Course 3 (3)			
Learner Development (2)	Learning and Instructions (2)	Software Engineering (3)	Human-Computer Interaction (3)	Elective Course 1 (3)			
Discrete Mathematics (3)	Studies on Curriculum (2)	Web Programming (3)	Digital Image Processing (3)	Elective Course 2 (3)			
Linear Algebra (3)	Algorithms and Programming (3)	Data Structure and Algorithm Analysis (3)	Artificial Intelligence (3)	Elective Course 3 (3)			
Basic of Computer System (3)	Information System (3)	Microprocessors and The Basis of Robotics (3)	Computer Network (3				
Introduction to Computer Architecture and Organization (2)	Operating System (3)	Object-Oriented Programming (3)	Mobile Programming (3)				
	Database (3)						
20	**24**	**24**	**24**	**21**	**14**	**14**	
A TOTAL of 147 SEMESTER CREDIT UNITS							

* courses offered to students outside the study program as interdiscipline courses.

Legenda:

Compulsory Course (MKWU)	Core Study Course (MKIK) – Educational Science Courses (MKKK)	Core Study Course (MKIK) - Scientific Field of Study Courses (MKBS)	Supporting Science and Technology Courses (MKIP)	Study Programme Specific Courses (MKPP/MKPI)

The following table is a description of the courses:

Num.	Courses	Description
1	Educational Insight	After taking this course, students will know the basic knowledge of education and its implementation in the education system. Educational Insight discusses the concept of education, the spectrum of educational knowledge, educational theory, the education system in Indonesia, and the teaching profession. Activities in this course include defining, describing, and identifying education in the education system in Indonesia. The assessment used is an authentic assessment through attitude and participation, Assignment assessment, UTS, and UAS.
2	Learners Development	After following this course, students can find out their characteristics and implementation in education. Learners Development discusses the scope of psychology in Learners Development, the nature of students, aspects of childhood development, children, adolescents, adults, multiple intelligence, reward and punishment, developmental theories. This course includes describing concepts and characteristics of Learners Development in infancy, childhood, adolescence, and adulthood. The assessment used is authentic assessment through attitude and participation, assignment assessment, UTS, and UAS.
3	Discrete mathematics	After taking this course, students can analyze and implement basic mathematical concepts and theories in various areas by modeling and solving various problems with the help of related mathematics and computing. Discrete Mathematics discusses the logic of propositions, sets, relations, functions, number theory, counting, graph theory, and tree theory. This course includes studying, exploring, and applying basic mathematical concepts to solve a mathematical case. The assessment used is looking at the activity, completeness of tasks, UTS, and UAS with a problem-based.
4	Linear Algebra	After following this course, students can describe and analyze the concepts of linear algebra. Linear Algebra discusses systems of linear equations, matrix concepts, determinants of matrices, vectors in 2-dimensional and 3-dimensional spaces, vector spaces, linear transformations, eigenvalues and eigenvectors, and the concept of diagonalization. Activities in this course include studying, exploring, and applying the basic concepts of linear algebra to solve a mathematical case related to linear algebra. The assessment is done by seeing the activeness of students, completeness of portfolio assignments, Mid Semester Test with problem-based method and End Semester Test with project-based or problem-based method.
5	Basic Computer System	After taking this course, students can understand the general description of computers and Information Technology along with software and hardware. Basic Computer Systems discusses the types of hardware from mechanical devices to electronic devices, Computer systems, Computer skills, How to master computers, Current computers, Future computers, software development, How to install computer software, Definition of programming, Programming algorithms, K3LH. Activities in this course include tutorials, practicum, and discussions synchronously (in-class/lab/teleconference) and

		asynchronously (through e-learning media). The assessments used are independent assignments, group assignments, and product presentations.
6	Introduction to Computer Organization and Architecture	After taking this course, students can learn more about the architecture and organization of a computer. Introduction to Computer Organization and Architecture discusses the evolution and performance of computers, the interconnection structure of computer components known as the system bus, memory especially cache, internal and external memory, I/O modules and CPU as part of computer components, Operating System Support, Computer arithmetic, understand more deeply about the instruction set such as its function, characteristics, format and addressing technique. This course includes an expository approach in lectures, discussions, questions, answers, and independent learning using various media. The assessment used is through several quizzes, individual homework, and group assignments directly delivered in class or via e-mail, discussions, student activities, mid-semester exams, and end-semester exams.
7	Instructional Learning	After taking this course, students can analyze and implement theoretical concepts in Instructional Learning. Instructional Learning discusses the nature of learning, learning outcomes, factors that influence learning outcomes, learning theories, learning models, learning methods, and lesson plans. Activities in this course include listening to modules/references related to learning and learning concepts, compiling papers on learning models and methods, presenting learning models and methods. The assessments used are participation in discussions, assignments, presentations, UTS, and UAS.
8	Curriculum Study	After taking this course, students can analyze and evaluate the curriculum. Curriculum study discusses the basic concepts of curriculum, curriculum principles, curriculum evaluation, curriculum development in Indonesia (curricula before 1945, 1947, 1957, 1968, 1974, 1984, 1994, 2004 or KBK, KTSP, K13). This course includes reading modules related to curriculum concepts, presenting curriculum developments, and conducting curriculum evaluations. The assessment used is a project assessment.
9	Vocational Education	After taking this course, students can analyze the planning and implementation of learning in *Sekolah Menengah Kejuruan* (SMK) or vocational schools specifically for TKI expertise (Computer and Informatics technology). Vocational Education discusses the principles, characteristics, and roles of vocational education, competency-based learning, 21st-century vocational teacher competencies, vocational education link and match strategies with the needs of DUDI, work-based learning (WBL), K3 concepts in vocational learning, vocational practice learning planning. This course includes designing learning scenarios in vocational schools and designing scenarios for practical laboratory learning. The assessment used is to see the activity, completeness of portfolio assignments, UTS with problem-based and UAS with project-based or problem-based.
10	Algorithms and Programming	After following this course, students can describe algorithmic problems systematically, analyze solutions to algorithmic problems, design programme code structures for implementation of algorithmic solutions.

		Algorithms and Programming discuss the basic concepts of algorithms, programming paradigms, schemes / basic programme structures, including sequential schemes, conditional schemes, looping schemes, basic data structures in programming. Activities in this course include writing algorithms, writing programme code from algorithm designs, finding errors from a programme code, testing the correctness of algorithms and programme codes resulting from their implementation. The assessment presents the proposed algorithm scheme, individual programming practicum, group programming practicum, program demo.
11	Information Systems	After taking this course, students can analyze basic information system concepts in computer-based organizations/companies, accounting, marketing, human resources, and executive information systems. Information Systems discusses the basic concepts of information systems, information system management, application, network information systems, electronic information systems, supply chain management. Activities in this course include studying the concept of information systems and analyzing an existing information system. The assessment used is by looking at activity, completeness of tasks, UTS with a problem-based and final exam with project-based.
12	Operating System	After following this course, students can describe and analyze the basic concepts of computer operating systems. Operating System discusses the introduction of computer systems, the structure of computer operating systems, processes and threads, CPU scheduling, synchronization, deadlocks, memory management, and storage media, as well as protection and security systems, and ends with a case study on the DOS operating system (Disk Operating System). Activities in this course include studying, exploring, and applying the basic concepts of operating systems to understand computer performance/operations. The assessment used is to see the activity, completeness of portfolio assignments, UTS with problem-based and UAS with project-based or problem-based.
13	Database	After taking this course, students can design and develop relational databases. Database discusses Database Concepts, Entity Relational Diagrams, Database Normalization, Structured Query Languages, Database Projects. Activities in this course include Studying Database Concepts, Designing Databases with ERD, Normalizing Databases, Implementing Databases with Query Languages, Database Projects with real case studies. The assessments used are Assignments, UTS, UAS.
14	Learning Strategy and Design	After taking this course, students can analyze innovative learning designs with components (HOTs, TPACKs, and 4Cs). Strategy and Learning Design discusses the principles, basic assumptions of learning design, innovative learning strategies, competency-based learning concepts, identification of learning design needs, the concept of preparing general and specific learning objectives, approaches, models and innovative learning strategies, analysis of learning outcomes assessment, learning design innovative. Activities in this course include studying the principles, basic assumptions of learning design, describing competency-based learning, identifying and analyzing learning design needs, setting general and specific learning objectives. The

		assessment used is by looking at activity, completeness of tasks, UTS with a problem-based and final exam with project-based.
15	Instructional Assessment and Evaluation	After taking this course, students can analyze and develop both test and non-test types of instruments. Instructional Assessment and Evaluation discusses the basic concepts of assessment and evaluation, develops both test and non-test instruments, including validity test, reliability test, test difficulty level, discriminatory power test, and distractor effectiveness test. Activities in this course include learning the basic concepts of assessment, compiling instruments (test and non-test types), conducting instrument testing (validity, reliability, discriminatory test, effectiveness of distractors), analyzing tested instruments. The assessment used is a project assessment, product assessment.
16	Statistics	After following this course, students can analyze problems in inferential statistics as a basis for making decisions with the help of SPSS applications as tools in the data processing. Statistics discusses the basic concepts of Statistics, Descriptive Statistics and Inferential Statistics, Set Theory and Statistical Probability, Theoretical Probability Distribution, Binomial Distribution, Poisson Distribution, Normal Distribution, Sampling and Sampling Distribution, Statistical Estimation, Hypothesis Testing, and Data Processing with SPSS. Activities in this course include studying basic statistical concepts, applying Normal distribution using statistical tables, applying hypothesis testing, implementing data processing with SPSS. The assessment used is by looking at activity, completeness of tasks, UTS with a problem-based and final exam with project-based.
17	Learning Multimedia	After following this course, students can implement Basic Multimedia Concepts, text and Multimedia aids, sound and audio, images/images, videos, 2D animations that support the learning process. Multimedia Learning discusses the Basic Concepts of Multimedia, text and multimedia aids, sound and audio, images/images, videos, 2D animations that support the learning process. Activities in this course include group discussions, case studies, project-based learning, problem-based learning. The assessment used is a performance assessment.
18	Software engineering	After following this course, students can analyze and compile software requirements in software requirements specification documents. Software Engineering discusses the software development cycle, requirements analysis, non-functional software functional requirements, document standards and components in software requirements analysis, UML, software interfaces, testing, and maintenance. Activities in this course include listening to modules/references related to software engineering concepts, analyzing software requirements, both functional and non-functional requirements, compiling software requirements specification documents. The assessment used is the Assessment Project.

19	Web Programming	After following this course, students can design web applications using the MVC or modular paradigm, master the basics of web programming as a full stack developer, and choose the right web technology. They are designing web applications using the MVC or modular paradigm, mastering the basics of web programming as a full stack developer, able to choose the right web technology discussing web technology, web frontend development, web backend development, server-side web programming language, pure javascript, pure CSS, framework javascript, CSS framework, modular programming paradigm, MVC programming paradigm, designing web-based applications, using relational databases. Activities in this course include studying, analyzing, designing, and implementing web programming to solve a problem. The assessment used is an assessment by looking at the originality of ideas, creativity, completeness, and level of complexity of the task, UTS, and UAS with problem-based.
20	Data Structures and Algorithm Analysis	After taking this course, students can design programmes using a choice of data structures and algorithms that are more effective and efficient. Data Structures and Algorithm Analysis discuss the basic concepts of modular programming, the basic concepts of the transversal algorithm on 1-dimensional arrays, the basic concepts of searching, the basic concepts of 2- and N-dimensional arrays, the basic concepts of stack and queue. Activities in this course include writing algorithms, writing programme code from algorithm designs, finding errors from a programme code, testing the correctness of algorithms and programme codes resulting from their implementation. The assessment used is presenting the proposed algorithm scheme, individual programming practicum, group programming practicum, programme demo.
21	Microprocessors and Basic Robotics	After following this course, students can understand microcontrollers and simulate simple LEDs, buttons, sensors. Microprocessor and Basic Robotics discusses the concept of a microcontroller, a led circuit, a button circuit, and simulation with sensors. Activities in this course include explaining the type of microcontroller, explaining and simulating the use of LEDs, explaining and simulating the use of buttons, explaining and simulating the use of simple sensors. The assessments used are student activity, completeness of assignments, UTS, and project-based UAS.
22	Object-Oriented Programming	After following this course, students will be able to understand the concept of object-oriented, object-oriented programming in the Java language. Object-Oriented Programming discusses Object-Oriented Concepts, Java, Java Classes. Activities in this course include understanding object-oriented concepts with Alice 3, Practicing understanding of Java coding with Greenfoot, Programming Object Oriented with Java (Eclipse). The assessments used are Assignments, UTS, UAS.
23	Microteaching	After taking this course, students can understand eight teaching skills and apply them in classroom learning. Micro-Learning discusses the skills of asking questions, giving reinforcement, explaining, managing classes, teaching small groups, guiding small group discussions, opening and closing lessons. Activities in this course include understanding the eight teaching skills and doing micro-learning practices in the classroom. The assessments

		used are Assignments, UTS, UAS.
24	Entrepreneurship	After taking this course, students can explain, apply and make an entrepreneurial lifestyle to communicate, lead and apply business management in managing a business. Entrepreneurship discusses Character Competence, Communication, and Interpersonal Competence, Creativity and Innovation Competence, Competence to sell products or services, Business Management Competence. Activities in this course include learning the basic concepts of entrepreneurship, designing a business plan, and designing a business. The assessment used is a project assessment.
25	Human-Computer Interaction	After taking this course, students can understand system design according to the concept of user experience and design a prototype design of a system based on user needs that refer to the principle of user experience design. Human-Computer Interaction discusses the basic concepts of human-computer interaction, usability paradigms and principles, User-Centered Design (UCD) concepts, User Experience (UX), User Interface (UI), user needs analysis, personas, task analysis, prototyping, and techniques evaluation. Activities in this course include tutorials, practicum, and discussions synchronously (in-class/lab/teleconference) and asynchronously (through e-learning media). Apart from studying individually, students are also directed to work together in a group. The assessments used are independent assignments, group assignments, and product presentations.
26	Research methodology	After taking this course, students can design good and correct research according to the research methodologies that they are interested in. The Research Methodology discusses the perspectives of Research Methods, Educational Research Paradigms, Computer science/Informatics research paradigms, Video stages of research, Measurement scales and research instruments, Data Collection and Analysis Techniques, Reviewing articles from various types of research, Making good research proposals. Activities in this course include reviewing articles on the types of CAR, Experiments, Educational Engineering, and Informatics Engineering; Classify the stages of research according to the type of research; Designing research methods according to the type of research selected in the form of a proposal. The assessments used are portfolio and project assessments.
27	Digital Image Processing	After following this course, students can implement various basic image processing algorithms into a digital image. Digital Image Processing discusses the concept of natural imagery, sampling & quantization, point operations, filtering, color space, morphology. Activities in this course include understanding the concept of natural images, sampling & quantization processes, applying point operation algorithms, filtering, converting color space, and applying morphological operations to digital images. The assessment used is looking at student activity, completeness of assignments, UTS with problem-based, and UAS with project-based.
28	Artificial intelligence	After taking this course, students can discuss several techniques and methods of artificial intelligence and their applications that can be used to solve problems in the real world. This course's topics include the concept of

		artificial intelligence, introduction to fuzzy logic concepts, genetic algorithms, data science, machine learning, artificial neural networks, deep learning, and convolutional neural networks. Artificial Intelligence discusses artificial intelligence techniques and methods and their applications that can be used to solve real-world problems. This course's topics include the concept of artificial intelligence, introduction to fuzzy logic concepts, genetic algorithms, data science, machine learning, artificial neural networks, deep learning, and convolutional neural networks. Activities in this course include understanding the concepts of artificial intelligence and implementing artificial intelligence coding in a case. The assessments used are student activity, completeness of assignments, UTS, and project-based UAS.
29	Computer network	After taking this course, students can explain the basic concepts of computer networks and demonstrate computer network configuration skills. Computer Networking discusses the basic concepts of data communication, computer networks, communication protocol architecture, communication protocols that are in the OSI layer model, especially the physical, data link, and network layers, UTP cabling practices, server administration practices using Virtual Machines, and analytical practices such as capturing packets using Wireshark. Activities in this course include studying, exploring, applying, and evaluating. The assessment used is a performance assessment.
30	Mobile Programming	After taking this course, students can master the basics of mobile programming and provide efficient and productive mobile computing services. Mobile Programming discusses mobile application technology, layout, widgets, mobile programming languages, designing mobile-based applications, mobile services, mobile networks, SQLite. Activities in this course include studying, analyzing, designing, and implementing mobile programming to solve a problem. The assessment used is an assessment by looking at the originality of ideas, creativity, completeness, and level of complexity of the task, UTS, and UAS with problem-based.
31	2D Animation Basics	After taking this course, students can master hard skills in the form of basic concepts of 2D Animation and soft skills in the form of solving various problems using the concept of 2D Animation Film production. Basic 2-Dimensional Animation discusses the basic theory of Pre-Production, Production, and Post-Production, as well as practicum techniques for motion, tweening, stop motion, keyframe, and frame by frame. Activities in this course include studying the basic concepts of Pre-production, Production, and Post-production of 2-dimensional Animation using motion, tweening, stop motion, keyframe, and frame by frame techniques. The assessment used is the Assessment Project.
32	Network Security	After taking this course, students can understand security issues in building a network or information system. Network Security discusses Cybercrime Classification, Security Principles, Cryptography, Footprinting, Reconnaissance, Enumeration, Vulnerability Analysis, System Hacking. Activities in this course include studying, exploring, applying, and evaluating. The assessment used is Attitude and Performance assessment.

33	Network Administration	After taking this course, students can master the theoretical concepts of infrastructure and network system administration, practice learning with infrastructure and network system administration content, integrate learning skills and the use of technology in the application of infrastructure and network system administration, as well as apply, study, and create designs. to solve problems within the scope of network infrastructure and system administration. Network Administration discusses Network Operating Systems and Virtual Machines, Server Administration, VLAN Administration, Firewall Administration and NAT. Activities in this course include studying, exploring, applying, and evaluating. The assessment used is a performance assessment.
34	Advanced Computer Network	After taking this course, students can analyze and perform troubleshooting appropriately related to problems in the world of computer networks. Advanced Computer Networking covers basic application, presentation, session, transport layer concepts, quality of service, VLAN practices, NAT practices, and dynamic routing practices. Activities in this course include studying, exploring, applying, and evaluating. The assessment used is a performance assessment.
35	Interactive Multimedia	After taking this course, students can understand the concept of interactive Multimedia and apply the manufacture of interactive multimedia products. Interactive Multimedia discusses Interactive Multimedia Concepts, Storyboards, User Interface Design, Introduction to Applications, Multimedia Elements, Page-based Interactive Multimedia Product Development, Application Introduction, Action Script Basics, Data Processing, Interactive Multimedia Product Development, Product Packaging. Activities in this course include group discussions, case studies, project-based learning, problem-based learning. The assessment used is a performance assessment.
36	Game Design	After taking this course, students can understand the concept of game and game design. Game Design discusses the concept of game design, the concept of Fun & Core Experience and Core loops in a game, the Process of Design & MDA Framework and how to find a Game idea, the concept of Game Balance and the techniques used, the concept of making Level designs, making Wireframes, create Screenflow, User Persona, Character, Control, Camera: 3C Design in a Game, CRESS Analysis, use Tools for Game Design, create Game Prototype. Activities in this course include group discussions, case studies, project-based learning, problem-based learning. The assessments used are performance assessment and project assessment.
37	Advanced Computer Animation	After following this course, students can master hard skills in the form of basic concepts of 3D Animation and soft skills in the form of solving various problems using the concept of 3D Animation Film production. Advanced Computer Animation discusses the theory of Pre Production, Production, and Post Production and various animation techniques, including Modeling, Rigging, Skinning, Controlling, Facial Expression, Animation, Simulation & Rendering. Activities in this course include understanding the basic concepts of 3D Animation and completing 3D

		animation production using one of the Animation Techniques studied by students. The assessment used is an assessment project.
38	Advanced Mobile Programming	After taking this course, students can Master advanced mobile programming and provide efficient and productive mobile computing services. Advanced Mobile Programming discusses mobile application technology, layout, widgets, mobile programming languages, designing mobile-based applications, mobile services, file management, mobile networks, sensors, real-time apps, advanced state management. Activities in this course include studying, analyzing, designing, and implementing mobile programming to solve a problem. The assessment used is an assessment by looking at the originality of ideas, creativity, completeness, and level of complexity of the task, UTS, and UAS with problem-based.
39	Advanced Web Programming	After taking this course, students can master advanced web programming based on popular frameworks and integrate various technologies to provide good web services. Advanced Web Programming discusses web application technology, templating, web programming languages, javascript frameworks, CSS frameworks, designing web-based applications, web APIs. Activities in this course include studying, analyzing, designing, and implementing web programming to solve a problem. The assessment used is an assessment by looking at the originality of ideas, creativity, completeness, and level of complexity of the task, UTS, and UAS with problem-based.
40	Advanced Database	After taking this course, students can Master Query Language, Master Advanced Query Language, Understand Distributed and Parallel Databases, Understand Data Mining, Understand Database Trends, and Non-Relational Databases. Advanced Database discusses the design methodology for databases and verifying their structural correctness (Database Development Life Cycle), Implementing databases and applications software primarily in the relational model, Implementing Query Language (Data Definition, Manipulation, & Control Language) - MySQL, Advance SQL (Procedure, Function, View, Triggers, Indexes), Implementing Database Administration including security and integrity policies relating to databases, The basic principles behind data warehousing and preparation for data analytics, Basic knowledge about Non-Relational Databases, and working in group settings to design and implementing database projects. Activities in this course include reading the material module, practicing query language, presenting material, and doing projects in teams. The assessments used are Assignments, UTS, UAS.
41	Advanced Image Processing	After this course, students can analyze digital image processing schemes/models from the dataset formation stage to image pattern recognition. Advanced Image Processing discusses the concept of datasets, dataset acquisition and formation techniques, dataset processing and ground truth formation, feature extraction, and image pattern recognition. Activities in this course include understanding the concept of datasets, how to build a dataset, making ground truths, extracting image features, and recognizing patterns in images. The assessment used is looking at student activity, completeness of assignments, UTS with problem-based, and UAS with project-based.

42	Advanced Robotics	After taking this course, students can implement robotics concepts for national-level robot competitions, develop legged robots, and develop flying robots. Robotics discusses the concept of robotics, servo principles, flight controller principles, simulating legged robots, simulating flying robots. Activities in this course include understanding robotics concepts, applying servo principles, applying flight controller principles, simulating legged robots, simulating flying robots. The assessment used is a student activity, completeness of assignments, UTS, and project-based UAS.
43	Big Data	After taking this course, students can implement big data techniques and applications to store, manage, and analyze data in solving problems. Big Data discusses the concept of big data, data processing techniques, data mining techniques so that certain patterns are obtained that can become useful information and applications and problems of implementing big data in real conditions. Activities in this course include tutorials, practicum, and discussions synchronously (in-class/lab/teleconference) and asynchronously (through e-learning media). The assessment used is a student activity, completeness of assignments, UTS, and project-based UAS.

*note:

1. UTS (Ulangan Tengah Semester) = Mid-semester Test
2. UAS (Ulangan Akhir Semester) = Final-semester Test