SUMMARY OF CURRICULUM

UNDERGRADUATE PROGRAM OF INFORMATIC ENGINEERING

FACULTY OF ENGINEERING
UNIVERSITAS NEGERI SURABAYA
2023

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A. OBJECTIVES OF THE DEGREE PROGRAM

Institution Vision and Mission

The vision of Universitas Negeri Surabaya is as follows:

"Excellent in Education Strong in Science"

The mission of Universitas Negeri Surabaya is as follow:

1) Organizing education and learning centered on students by using an active learning approach and optimizing the use of technology
2) Conducting research in education, natural sciences, social and cultural sciences, arts, and / or sports, and technological development whose findings are beneficial for the development of science and public welfare
3) Disseminating science, technology, arts and culture, and sports, and the results of research through community service-oriented towards empowering and civilizing the community
4) Realizing Unesa as a center of education, mainly primary and secondary education and a scientific center based on the noble values of national culture
5) Organizing an autonomous, accountable, and transparent tertiary education institution to guarantee and improve quality and improve quality continuously.

The vision of the Faculty of Engineering is as follows:

"Excellent in Technology and Vocational Education"

The mission of Faculty of Engineering is as follow:

1) Providing quality education that is relevant to the needs of the global job market and the development of science and technology, which refers to the National Standards of Higher Education.
2) Improve the quality of educators and education personnel, the quality of facilities and infrastructure to support continuous improvement in the quality of the learning process.
3) Develop research in the field of technology and vocational education based on professionalism to be applied in the context of community service and education.

4) Build institutions that are healthy, efficient, effective, productive, transparent, accountable, prosperous, and fair.
5) Develop cooperation with related national and international institutions on an ongoing basis.
6) Produce educational and non-educational staff who are competent, professional, religious, creative, independent, and have the spirit of leadership and are capable of entrepreneurship.

Program Education Outcome (PEO)

The Undergaduate Program in Informatic Engineering aims to produce graduates in the field of Informatic Engineering who have abilities:

1) Individuals with profound knowledge in software development and programming. They have developed strong skills in analysis, design, implementation, and maintenance of software systems.
2) Individuals who excel in providing technical support and solutions for computer and network issues. They possess strong technical skills, a deep understanding of IT infrastructure, and good communication abilities.
3) Individuals who not only have a deep understanding of technology but also strong business skills to establish and manage their own technology ventures. This graduate profile encompasses various aspects that reflect a combination of technological expertise and entrepreneurial spirit.

Table 1. The objective of The Undergraduate Program in Informatic Engineering versus the 6th Level of National Qualification Framework

	Graduates have the ability to analyze computing issues and apply computing principles and other relevant disciplines to identify solutions for organizations	Graduates have the ability to design, implement, and evaluate computation-based solutions according to user needs through appropriate approaches	Graduates are committed to continually developing themselves through lifelong learning	Graduates have the ability to think logically, critically, and systematically in applying knowledge in the field of informatics/computer science to address real-world problems
PEO-1	S	S	S	S
PEO-2	S	S	S	S
PEO-3	S	S	S	S
PEO-4	S	S	S	S

S-Strong, M-Moderate

Program Learning Outcomes (PLO)

The Undergraduate Program in Informatic Engineering sets the Program Learning Outcomes (PLO) for the graduates as follows:

Table 2. PLO of Undergraduate Program of Informatic Engineering

ASPECTS	PLO	CODE
KNOWLEDGE	Capable of analyzing complex computing issues to identify solutions for technology project management in the field of computer science/informatics, considering insights from the development of transdisciplinary knowledge.	KNO-1
	Capable of designing and simulating relevant multi-platform technology applications based on theoretical concepts in the field of computer science/informatics to meet industry and societal needs.	KNO-2
	Able to apply understanding of computer system functioning to address issues in information technology.	KNO-3
SKILL	Possesses teamwork skills.	SKI-1
	Capable of communicating the implications of research results in the development or implementation of information technology.	SKI-2
COMPETENCY	Capable of analyzing, designing, building, and evaluating user interfaces and interactive applications based on user needs and transdisciplinary knowledge development.	COM-1
	Ability to design, implement, and evaluate multi-platform computing-based solutions that meet organizational needs.	COM-2
	Capable of implementing computing requirements by considering various appropriate methods/algorithms.	COM-3
ATTITUDE AND SOCIAL	Committed to maintaining discipline in both societal and national contexts	SOC-1
	Demonstrates professional behavior through adherence to professional ethics, the ability to collaborate in multidisciplinary teams, understanding of lifelong learning concepts, and positive responses to social issues and technological developments (SNDIKTI).	SOC-2

Table 3. Correlation between the Objective of the Undergraduate Program in Informatic Engineering and the Program Learning Outcomes

	PEO-1	PEO-2	PEO-3	PEO-4
KNO-1	S	S	S	S
KNO-2	S	S	S	S
KNO-3	S	S	S	S
SK-1	S	S	S	S
SK-2	S	S	S	S
COM-1	S	S	S	S
COM-2	S	S	S	S
COM-3	S	S	S	S
SOC-1	S	S	S	S
SOC-2	S	S	S	S

S-Strong, M-Moderate

B. PROGRAM STRUCTURE

The Curriculum

The curriculum has reviewed and updated every four years to adapt the evolving dynamics of the outside world while maintaining a significant focus on core Informatics Engineering components. The current curriculum is designated as Curriculum 2023. The development of the curriculum is centered around:

1) Indonesian National Qualification Framework (KKNI) and National Standards for Higher Education.
2) 21st century skills needed, namely critical thinking and problem solving, creative and innovative, communication, and collaboration.
3) Association for Computing Machinery (ACM), Institute of Electrical Electronics Engineers-Computer Society (IEEE-CS), and Association for Advancement of Artificial Intelligence (AAAI) 2023.
4) Association of Informatics and Computer Universities (APTIKOM).

Based on the document "Computer Science Curricula 2023 Version Beta March 2023" have designed by the Association for Computing Machinery (ACM), Institute of Electrical Electronics Engineers-Computer Society (IEEE-CS), and Association for Advancement of Artificial Intelligence (AAAI), as its name suggests, the CS discipline has considered computer science as a central unit of analysis for research and teaching from the beginning. Commonly, "computer science" has defined as the study of algorithms, data structures, and the principles behind computing systems to solve problems and manipulate information efficiently. The computer science curricula 2023 has mentioned some competency areas of a program. Some competency areas are:

1) Software, consisting of the knowledge areas Software Development Fundamentals (SDF), Algorithms and Complexity (AL), Foundations of Programming Languages (FPL) and Software Engineering (SE).
2) Systems, consisting of some of the following knowledge areas: Systems Fundamentals (SF), Architecture and Organization (AR), Operating Systems (OS), Parallel and Distributed Computing (PDC), Networking and Communication (NC), Security (SEC) and Data Management (DM).
3) Applications, consisting of some of the following knowledge areas: Graphics and Interactive Techniques (GIT), Artificial Intelligence (AI), Specialized Platform Development (SPD), Human-Computer Interaction (HCI), Security (SEC) and Data Management (DM).
4) Theoretical Foundations of Computer Science, applicable to theoretical exploration of all the knowledge areas, such as pursued in preparation for graduate studies.

In other hand, competency areas are also correlated with skill levels. These pre-established skill levels play a crucial role as mediators between the knowledge model (encompassing knowledge areas, units, and topics) and the competency model (consisting of competency areas, units, and tasks), as depicted in Figure 1. This linkage serves to contextualize how knowledge is applied within distinct competencies, thereby enhancing the comprehension of the entire framework.

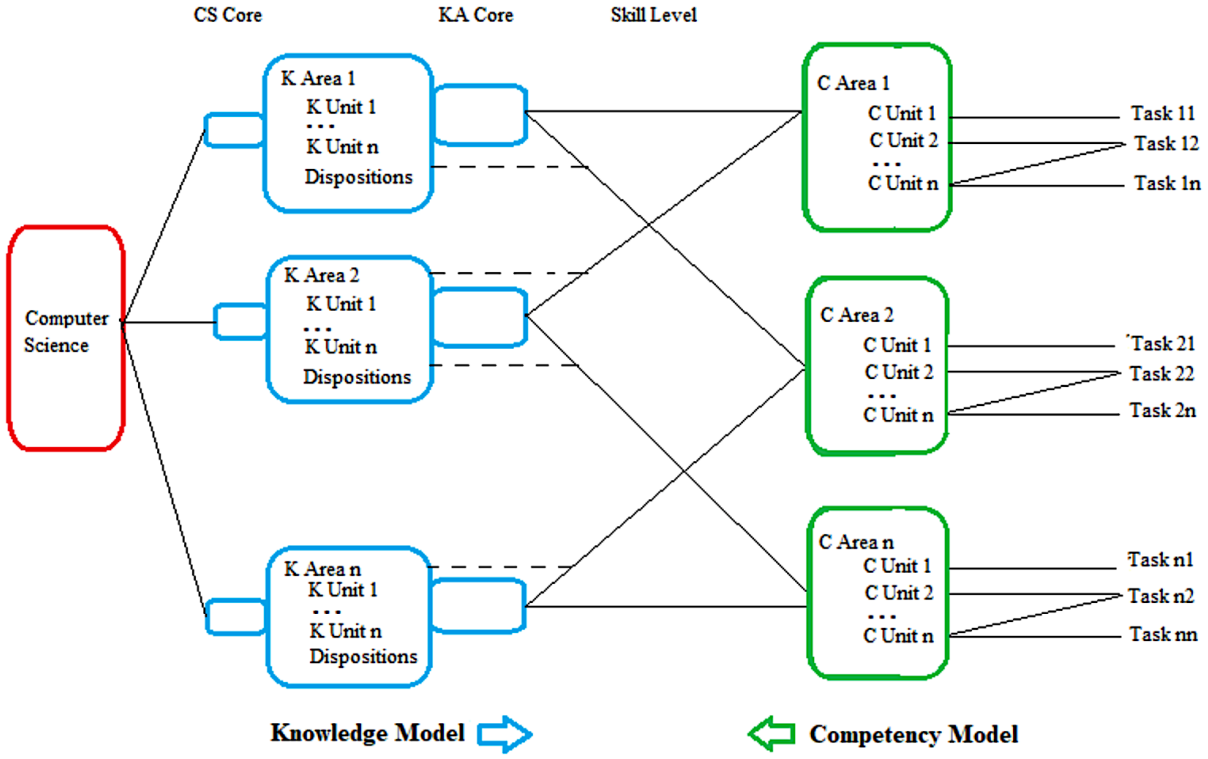


Figure 1. Knowledge Model versus Competency Model
Source: Computer Science Curricula 2023

Referring to the APTIKOM Curriculum Guidelines, which adhere to international best practices set forth by ACM and IEEE. Computer science, which emphasizes the ability of individual's ability to design and develop a variety of computing algorithms (theory of computation and algorithms), including:

a. A very diverse spectrum, from the highly theoretical and algorithmic to the highly applied such as the development of robotics and systems.
b. Divided into three main sections:
    i. Focus on the theories and algorithms used in the process of software design and implementation.
    ii. Focus on the theories and algorithms used in the process and design of hardware systems and their components.
    iii. Focus on theories and algorithms that are used as mathematical models in solving certain problems.
c. The curriculum is very thick with knowledge related to logic, math, computation, and algorithms, which in its applied model is stated as mathematics, computing, and algorithms, which in its applied model is expressed in the development of computer programs.

Name Variations: Informatics Engineering, Computer Science, Computational Science, Informatics, Informatics, Computational Mathematics, and so on.

The mechanism of curriculum development of Undergraduate Program of Computer Informatic Engineering (UPIE) is described as follows:

1) Forming curriculum development team in charge of producing the draft of UPIE curriculum.
2) Doing self-evaluation through analysis of comparative study results, analysis of tracer study results, results of on-going curriculum evaluation, demands of the need in the field, and SWOT analysis.
3) Determining the characteristics of UPIE specifications and graduate profile based on the graduate competencies formulated in PEO.
4) Determining the PLOs derived from PEO of UPIE.
5) Determining study materials (based on scientific trees) and inventory of relevant essential concepts which supports each of the PLO.
6) Determining the courses/modules included in the study material and distribution of essential concepts.
7) Determining the road map of each PLO achievement by making a map of course pathways that are mutually relevant to support the achievement of each PLO from semester 1 to semester 8.
8) Estimation and determination of study load (credit unit) and preparation of course descriptions.
9) Determining the staff who teach the courses in accordance with their respective areas of expertise
10) Preparing of Module Handbook and Semester Lesson Plans by considering the relevancy of teaching methodology which support PLO achievement and how each of assessment systems (midterm exam, final exam, and assignments) correlates with PLO.

The development processes of the curriculum adhere to several foundational principles of curriculum development. These principles, crucial in shaping the educational framework, are visually represented in Figure 2.

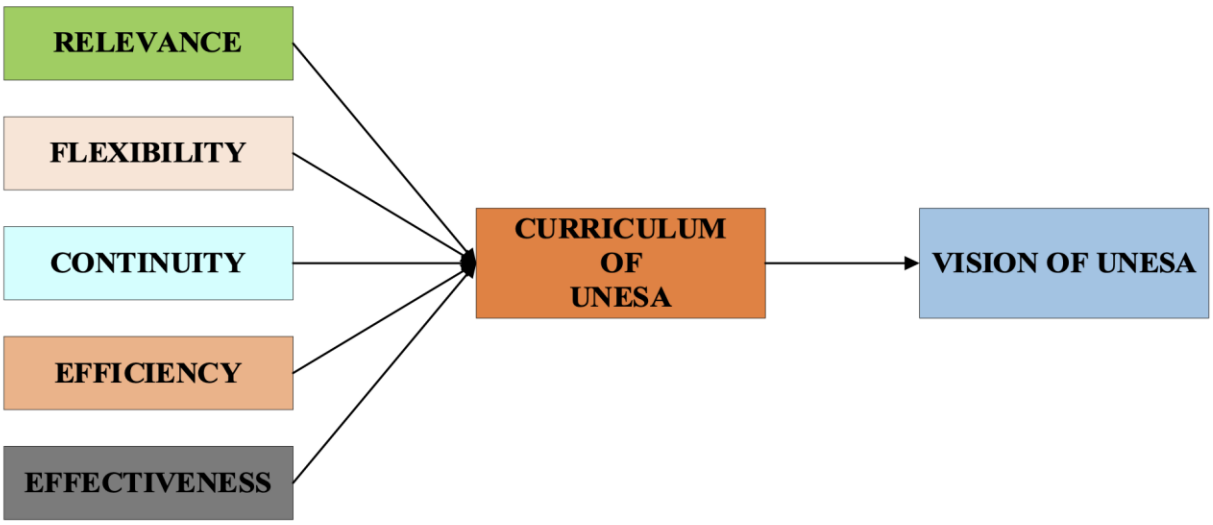


Figure 2. Principles of curriculum development

The Program Learning Outcomes (PLOs) of UPIE has closed align with the specialized learning outcomes outlined for Bachelor degree programs established by ASIIN (SSC-04: Informatics/Computer Science), as depicted in the following table.

Table 4. Specialist learning outcomes for Bachelor degree programmes created by ASIIN (SSC-04: Informatics/CS) and UPIE PLO

SPECIALIST COMPETENCES SSC	PLO Code												
	KNO-1	KNO-2	KNO-3	KNO-4	SKI-1	SKI-2	SKI-3	SKI-4	COM-1	COM-2	COM-3	SOC-1	SOC-2
Computer Science													
Special application area (Type 2 only)													
Shares of other specialist disciplines (Type 3 only)													
Mathematical and scientific/technical basics													
Other interdisciplinary basics and													

SPECIALIST COMPETENCES SSC	PLO Code												
	KNO-1	KNO-2	KNO-3	KNO-4	SKI-1	SKI-2	SKI-3	SKI-4	COM-1	COM-2	COM-3	SOC-1	SOC-2
transferrable key skills													

C. WORKLOAD AND CREDITS

The learning programme of UPIS uses a semester credit system (CU) where in one academic year it consists of two semesters, each entails 14 weeks. In one semester, the study load of each student ranges from 18 to 20 CU. One credit unit entails three types of activity per week for one semester. These activities are 50 minutes face-to-face (teaching and learning in class), 60 minutes of structured activities outside the classroom, such as doing assignments from lecturers, and 60 minutes of independent activities outside the classroom. Therefore, the student learning load for 1 credit is equivalent to 1.59 ECTS. The maximum total number of credits can be taken by student is 160 credits or equivalent to 254.4 ECTS. In order to graduate from this study programmes, a student should meet a minimum of 144 credits or equivalent to 228.96 ECTS. the calculation of the ECTS value is given as follows:

$$K = \frac{p \times q \times r}{25}$$

where,

K = ECTS value
p = Total credit
q = Total hours per credit
r = Total week per semester

To complete the learning program, students should take 144 credit units (CU) comprising 138 CU compulsory courses and 6 CU elective course.

Table 5. Distribution of Credit Units for UPIS Courses/Modules

CU compulsary courses	CU	Note
CU of compulsary courses	138	The CU courses are distributed into 53 course units distributed into 51 compulsory courses.
CU of elective courses	6	There are 18 CU from 6 elective courses
Total	144	

Table 6. Mapping of the Courses that Support the Program Learning Outcomes (PLO)

NO	CODE	MODULE	CU	ECTS	KNO-1	KNO-2	KNO-3	KNO-4	SKI-1	SKI-2	SKI-3	SKI-4	COM-1	COM-2	COM-3	SOC-1	SOC-2
1st Semester																	
1	1000002003	Pancasila Education	2	3,18									√				
2	1000002047	Indonesian	2	3,18												√	
3	1000002018	Mathematics	2	3,18													√
4	5720103001	Linear Algebra and Matrix	3	4,77	√				√								
5	5720103006	Computer Architecture and Organization	3	4,77		√			√				√				
6	5720103034	Basic Programming	3	4,77	√		√			√							
7	5720102038	Physical, Sports, and Health Education	2	3,18	√				√				√				
2nd Semester																	
9	1000002046	Religion	2	3,18					√					√		√	
10	1000002033	Citizenship Education	2	3,18					√					√			
11	5720103009	Discrete Mathematics	3	4,77			√					√			√		
12	5720103014	Operating System	3	4,77				√		√							√
13	5720102026	Data Structure	2	3,18				√			√				√		
14	5720103069	Digital Literature	3	4,77		√				√		√					
15	5720102031	Professional Ethics	2	3,18			√				√					√	
16	100000202x		2	3,18													√
3rd Semester1																	
17	5720102013	Human Computer and Interaction	2	3,18			√			√				√			
18	5720103015	Computational Science	3	4,77			√				√				√		
19	5720103033	Object-oriented Programming	3	4,77		√						√				√	
20	5720103040	Database	3	4,77	√							√					√
21	5720103046	Artificial Intelligence	3	4,77		√			√					√			
22	5720102078	Computer Networking	2	3,18				√				√		√			
4th Semester																	
25	5720103030	Platform-oriented Programming	2	3,18					√				√		√		
26	5720103068	Big Data	3	4,77	√			√	√			√					
27	5720103042	Software Engineering	3	4,77		√						√					
28	5720102045	Digital Image Processing	2	3,18	√				√								
29	5720103005	Statistics	3	4,77					√					√			
30	5720102017	Otomata Theorem	2	3,18		√					√						
5th Semester																	
32	5720103080	Software Analysis and Design	3	4,77			√			√			√				
33	5720103071	Internet of Things	3	4,77				√			√		√				
34	5720102070	Data and Information Security	3	4,77		√				√				√			
35	5720102062	Research Methodology	3	4,77			√			√							
36	5720103024	Entrepreneurship	3	4,77		√					√			√			
37	572010xxxx	Software Project Management	3	4,77			√			√			√				

NO	CODE	MODULE	CU	ECTS	KNO-1	KNO-2	KNO-3	KNO-4	SKI-1	SKI-2	SKI-3	SKI-4	COM-1	COM-2	COM-3	SOC-1	SOC-2
38	572010 xxxx	Machine Learning	3	4,77				√			√		√				
6th Semester																	
39		Internship Program Planning	2	4,77			√			√							
40		Internship Program Evaluation	2	4,77				√				√					
41		Enrichment Program 1	16	25,44	√			√				√		√			
7th Semester																	
42		Internship Program Planning	2	4,77			√				√			√			
43		Internship Program Evaluation	2	4,77	√				√								
44		Enrichment Program 2	16	25,44	√	√				√			√				
45	1000002104	Seminar	2	3,18				√			√						
8th Semester																	
46	5720106055	Thesis	4	6,36			√				√						

Table 7. List of Elective Modules in 5th Semester

NO	CODE	MODULE	CU	ECTS	KNO-1	KNO-2	KNO-3	KNO-4	SKI-1	SKI-2	SKI-3	SKI-4	COM-1	COM-2	COM-3	SOC-1	SOC-2
1		IT Service Management	3	4,77													
2		IT Audit	3	4,77													
3		Enterprise Information Systems	3	4,77													
4		Mobile Programming	3	4,77													
5		Business Intelligence	3	4,77													
6		Decision Support Systems	3	4,77													

Table 8. List of Enrichment Program 1 in 6th Semester

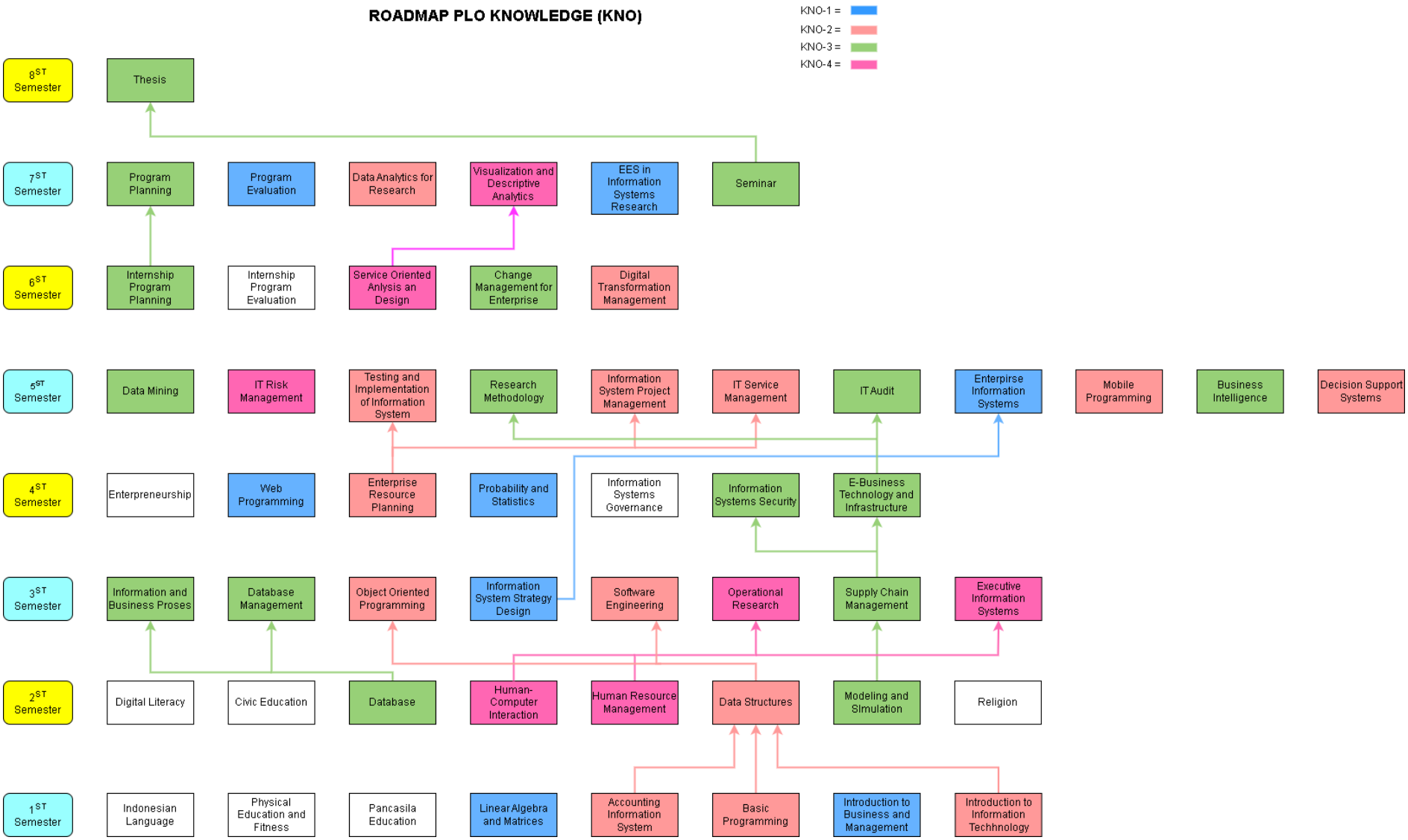
NO	CODE	MODULE	CU	ECTS	CSP	CIN	CRS	CEN	CIS
1		Community Project Implementation	4	6,36	√				
2		Community Project Design	4	6,36	√				
3		Employability Skills	4	6,36	√				
4		Entrepreneurial Skills	4	6,36	√			√	
5		Experience in Industry	4	6,36		√			
6		Requirement Analysis	4	6,36		√			
7		Solution Design	4	6,36		√	√		
8		Business Communication	4	6,36		√	√		
9		Research Experience	4	6,36			√		

NO	CODE	MODULE	CU	ECTS	CSP	CIN	CRS	CEN	CIS
10		Scientific Writing	4	6,36			√		
11		Venture Initiation	4	6,36				√	
12		Product Development Process	4	6,36				√	
13		Business Planning and Development	4	6,36				√	
14		Course Certification	4	6,36					√
15		Technical Skill Enrichment	4	6,36					√
16		Industrial Project	4	6,36					√
17		Soft Skill Enrichment	4	6,36					√

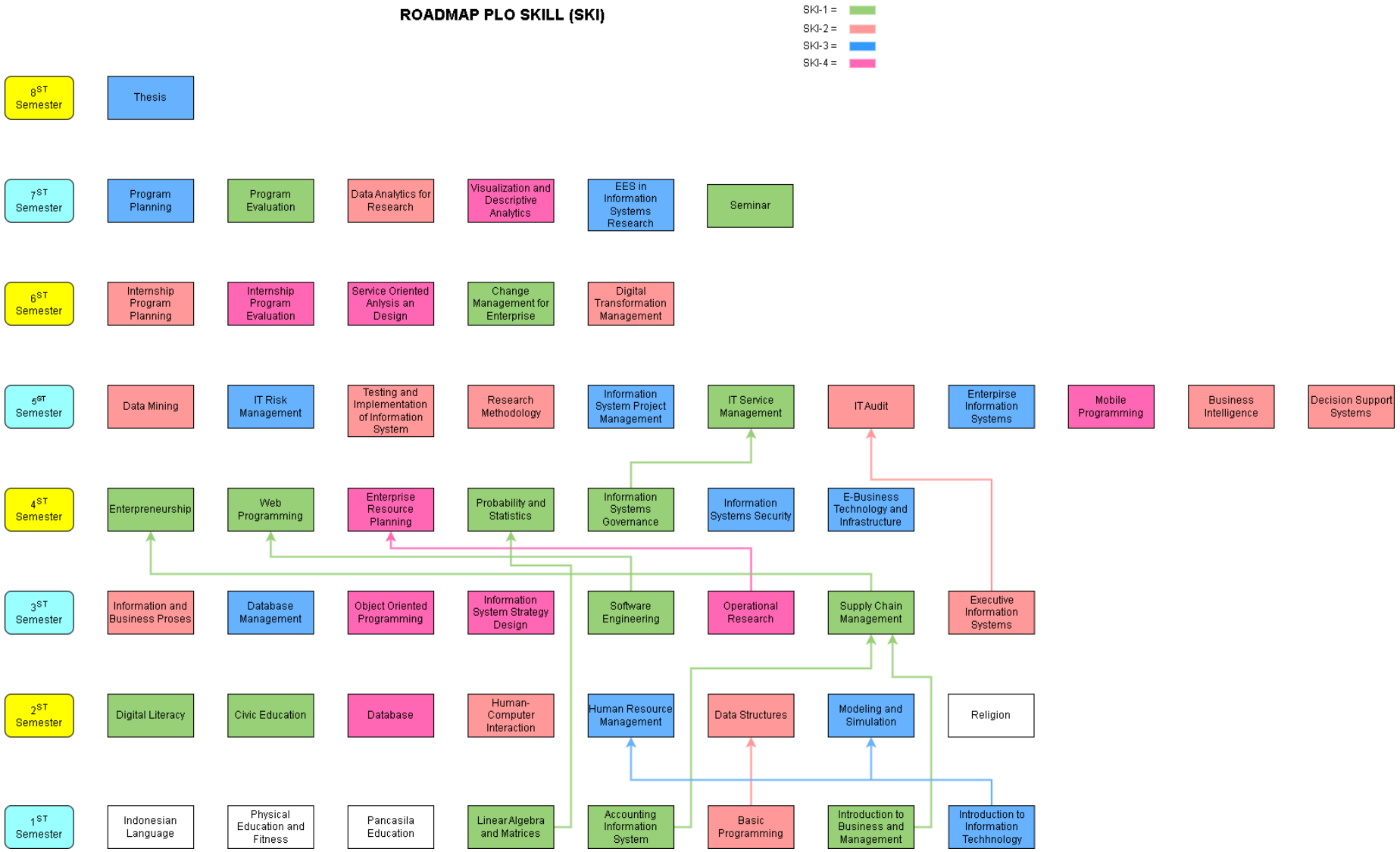
Table 9. List of Enrichment Program 2 in 7th Semester

NO	CODE	MODULE	CU	ECTS	CSP	CIN	CRS	CEN	CIS
1		Community Project Implementation in Information System	4	6,36	√				
2		Community Project Design in Information System	4	6,36	√				
3		Employability Skills in Information System	4	6,36	√				
4		Entrepreneurial Skills in Information System	4	6,36	√			√	
5		Experience in Information System Industry	4	6,36		√			
6		Requirement Analysis in Information System	4	6,36		√			
7		Solution Design in Information System	4	6,36		√	√		
8		Business Communication in Information System	4	6,36		√	√		
9		Research Experience in Information System	4	6,36			√		
10		Scientific Writing in Information System	4	6,36			√		
11		Venture Initiation in Information System	4	6,36				√	
12		Product Development Process in Information System	4	6,36				√	
13		Business Planning and Development in Information System	4	6,36				√	
14		Course Certification in Information System	4	6,36					√
15		Technical Skill Enrichment in Information System	4	6,36					√
16		Industrial Project in Information System	4	6,36					√
17		Soft Skill Enrichment in Information System	4	6,36					√

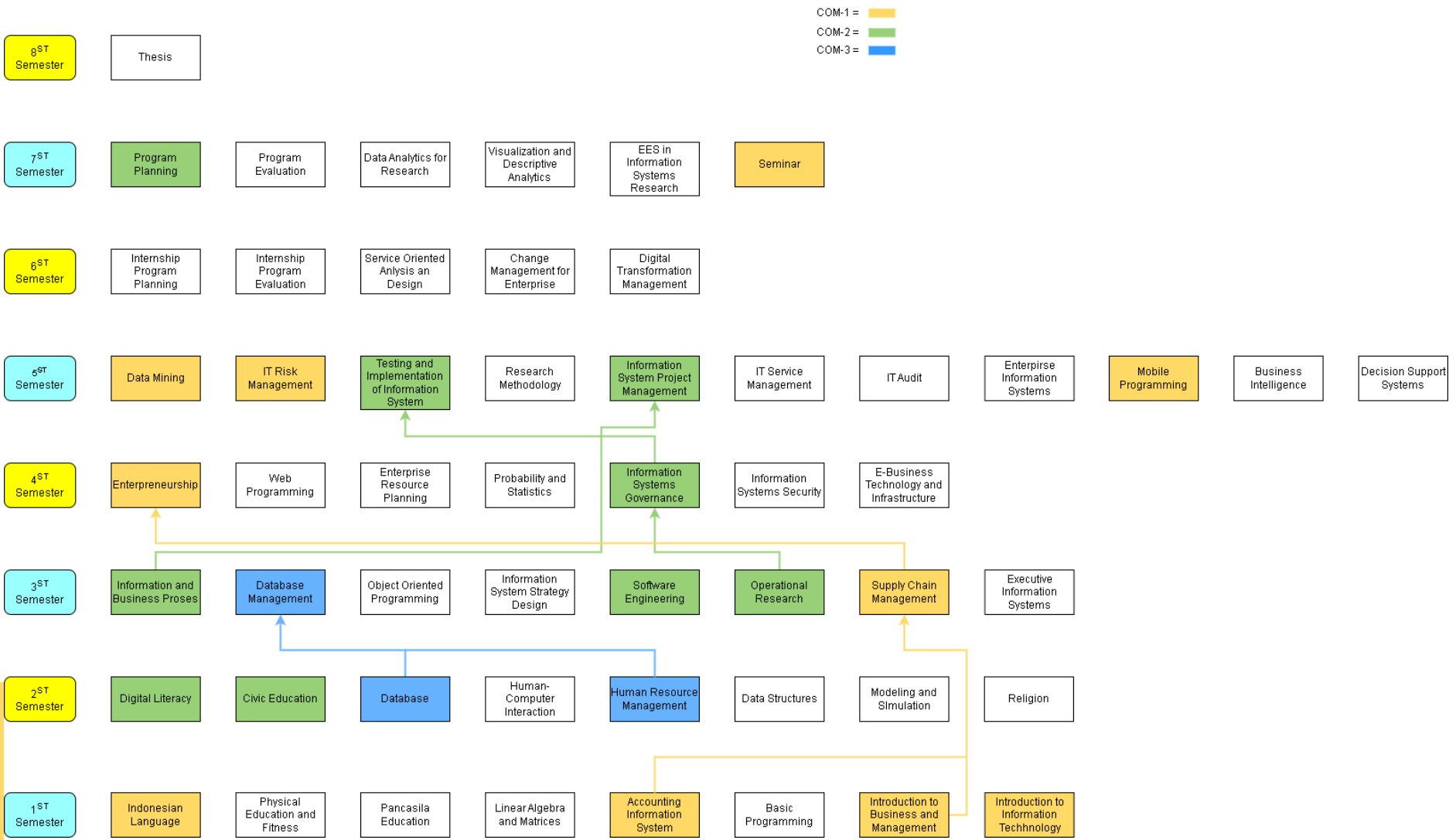
ROADMAP PLO KNOWLEDGE (KNO)



ROADMAP PLO SKILL (SKI)



ROADMAP PLO COMPETENCE (COM)



ROADMAP PLO SOCIAL (SOC)