UNNES 2020 CURRICULUM

INDEPENDENT LEARNING – INDEPENDENT CAMPUS

UNDERGRADUATE STUDY PROGRAM
CHEMICAL ENGINEERING

FACULTY OF ENGINEERING
UNIVERSITAS NEGERI SEMARANG
2020

PENGESAHAN

BUKU KURIKULUM 2020
PROGRAM STUDI SARJANA TEKNIK KIMIA
FAKULTAS TEKNIK
UNIVERSITAS NEGERI SEMARANG

Buku Kurikulum Program Studi Sarjana Teknik Kimia 2020 ini telah diselesaikan dan telah disahkan untuk dapat segera diimplementasikan.

Semarang, 04 November 2020

Mengesahkan

Dekan Fakultas Teknik	Kaprodi Teknik Kimia
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FOREWORD

The curriculum is the overall plan and arrangement regarding graduate learning outcomes, study materials, processes, and learning assessments that are used as guidelines for implementing study programs in higher education. Recognizing this, the Chemical Engineering Undergraduate Program at the Universitas Negeri Semarang has specifically programmed curriculum preparation activities that are able to support and encourage the development of an academic atmosphere within the Chemical Engineering Undergraduate Study Program environment.

This curriculum aims to provide detailed guidance on academic activities implemented by the Chemical Engineering Undergraduate Program at the Universitas Negeri Semarang based on the Permenristek Dikti. The curriculum of the S1 Engineering Study Program, Universitas Negeri Semarang is expected to improve the quality of education and produce high quality and efficient graduates.

PREFACE

Praise and gratitude the author prays to Allah SWT because thanks to His grace and gifts, the 2020 UNNES Curriculum for the Chemical Engineering Undergraduate Study Program can be completed on time.

This complete and systematic curriculum is expected to provide an explanation of the overall plans and arrangements for the course of education adapted by the Chemical Engineering Undergraduate Study Program. This explanation can be seen from the entire curriculum component that is part of this book. The curriculum components described in this book include identity, scientific groups, graduate profiles, learning outcomes, study material matrices, courses and descriptions as well as Semester Learning Plans (RPS) for each subject. Many people have been involved in the preparation of this book and the authors cannot mention one by one.

The authors would like to thank the writing team and all those who helped in the completion of this book. Hopefully the curriculum that has been compiled can be useful for all readers, especially stakeholders from the Chemical Engineering S1 Study Program, Universitas Negeri Semarang.

November 2020
Editor

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STUDY PROGRAM CURRICULUM

BACHELOR IN CHEMICAL ENGINEERING

I. Study Program Identity

1	**Study Program Name**	**Chemical Engineering**
2	**Permission**	S.K. DIKTI No. 266/E/O/2012, August 3, 2012
3	**Accreditation**	B (3675/SK/BAN-PT/Akred/S/X/2019)
4	**Title**	Bachelor of Engineering (S. T.)
5	**Description**	Chemical Engineering Study Program-UNNES is an institution that produces graduates who are able to develop ways of processing raw materials into products with processes that involve changes in composition and/or energy content economically.
6	**Vision**	To become a study program with conservation insight and international reputation in the field of Chemical Engineering entering industry 4.0
7	**Mission**	1. Organizing an educational process based on real problems in the chemical industry and solving them with relevant knowledge; 2. Organizing a learning system that is conducive to developing personality, character, and conservation insight and emphasizing reasoning and flexibility in application; 3. Organizing engineering education process that is oriented towards the design of chemical processing systems and equipment; 4. Improve the ability to research in the field of chemical engineering and design chemical processing systems to produce products that have international competitiveness and devote the results to society.
8	**Objective**	Produce graduates who have: a. ability to apply knowledge of mathematics, chemistry and other sciences related to physics and/or biology; b. the ability to design and carry out engineering experiments, as well as analyze and interpret data; c. the ability to design a system, component, process, or product to meet certain needs by taking into account realistic constraints; d. the ability to participate in multi-disciplinary and multi-cultural (international) groups;

		e. ability to identify, formulate, and solve engineering problems; f. understanding of professional responsibilities and ethics; g. the ability to communicate effectively; h. mastery of broad knowledge to understand the global, economic, environmental and socio-cultural impacts of engineering solutions, as well as on contemporary issues; i. awareness of the importance of lifelong learning and the ability to implement it; j. the ability to utilize the latest engineering techniques, skills and tools necessary to carry out their professional duties; k. awareness of the importance of conservation values in the professional practice of chemical engineering.

II. Results of Curriculum Evaluation and Tracer Study

The curriculum that is currently running in the Chemical Engineering Undergraduate Study Program is the 2015 and 2019 Curriculum. In the 2019 Curriculum there is a change in the number of courses from 74 in the 2015 Curriculum to 75. The addition is due to the addition of the Digital Literacy and Humanity MKU. This is done to support the goal of Universitas Negeri Semarang to create graduates who are capable of using information and communication technology. As a substitute for the addition of these courses, there is a reduction in credits for the Physical chemistry and Calculus II courses which were originally 3 credits to 2 credits each with the aim of adjusting the total number of credits that students must take to graduate, which is 144 credits.

III. Basis for Design and Development of Curriculum and Scientific Groups of Study Programs (Body of Kowledge in the Field of Science)

Body of knowledge study program

The body of knowledge or knowledge and expertise that will be held by the Chemical Engineering Study Program-FT UNNES covers the fields of chemical engineering, Indonesian natural material processing expertise, as well as other fields of science such as supporting basic science and expertise in other fields that are appropriate and support chemical engineering knowledge. These sciences have a constellation with similar fields of Chemical Engineering at the S1 to S3 levels so that the knowledge held is the initial provision to continue to the educational strata of higher chemical engineering (S2) or professional engineering programs in chemical engineering. The knowledge and expertise of the study program that is carried out is closely related to the basic science clusters, including calculus I and II, chemistry, and physics as well as supporting science clusters in the form of expertise in other fields such as safety and processing of processed waste, utilities, management and economic evaluation that will support knowledge , abilities, and attitudes of graduates. In the Chemical Engineering Undergraduate Study Program, FT-UNNES, the design, analysis, and control of chemical, physical, and/or biological processes and operations as well as product design and development, waste treatment, as well as processing and development of Indonesian natural materials are studied. The flow chart of the body

of knowledge of the Chemical Engineering S-1 Study Program FT-UNNES is broadly shown in **Figure 3.1.**

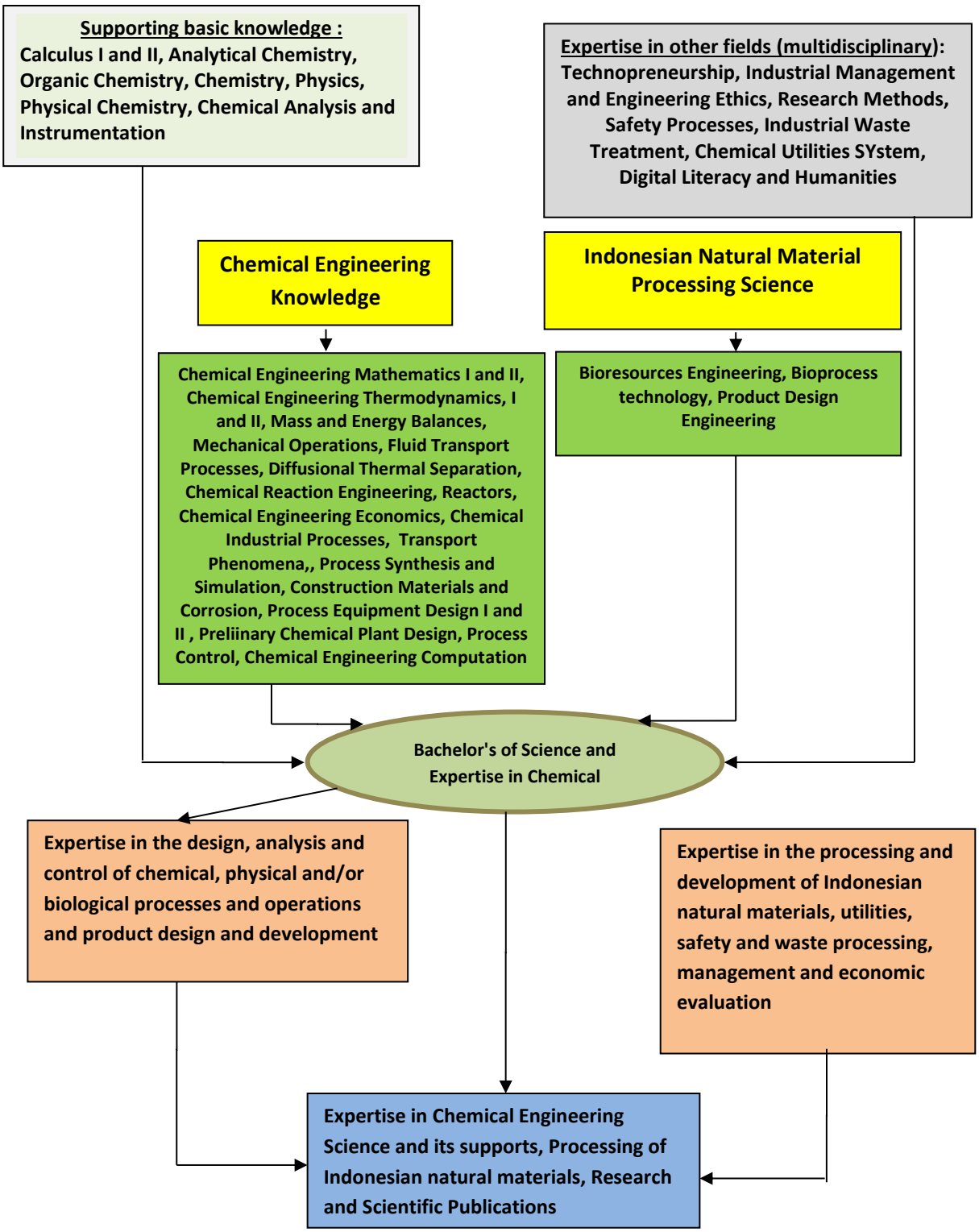


Figure 3.1. Scientific and Expertise Relation Map of Chemical Engineering Study Program with Other Fields

IV. Formulation of Vision, Mission, Objectives, Strategy, and University Values.

In addition to designing, controlling, and analyzing chemical, physical, and/or biological processes and operations as well as treating waste and applying other fields of expertise that support chemical engineering science, graduates of the Chemical Engineering S1 Study Program FT-UNNES must also be able to study and apply developments in engineering science. Indonesian chemicals and natural materials in accordance with their expertise based on scientific principles, procedures and ethics in order to produce solutions, innovations, ideas, and designs, then compile scientific descriptions of the results of their studies and or publish in the form of reports, journals or in the proceedings of seminars. Therefore, these studies are developed by looking at the latest and popular trends in chemical engineering research. The development of chemical engineering trends leads to the development of energy derived from natural materials, environmental conservation and also food development. These research trends are elaborated and combined with research themes from the lecturers of the Chemical Engineering Study Program, FT-UNNES, in accordance with their respective field specializations with funding sources that have been obtained from various research schemes. Researches in chemical engineering are related to the downstreaming and commercialization of products on an industrial scale. Research and community service are correlated with the material taught in the Chemical Engineering Study Program to follow the development of chemical engineering science and meet the needs of the community.

V. Graduate Profile and Study Program Description

Table 5.1. Graduates of the Chemical Engineering Undergraduate Program Profile Matrix

Profile	Description		
	Field of work	**Form of work**	**Institute**
Chemical **Industrial** Manager	Plant Control, Operational manager	Improve and manage production processes	Government/private
Chemical **Process** Engineer	Engineering Process	Implement, evaluate, and control the processes running in the industry	Government/private
Lecturer/Researcher	Researcher in the field	Research	Government/private
	Researcher in the laboratory	Research	Government/private
	Lecturer at University/trainer	Implementing the Tri Dharma of Higher Education	Government/private
Engineering and Procurement Construction **Consultant**	Consultant	Provide recommendations, evaluation, and optimization of industrial tool designs	Government/private
Technopreneur	Production	Processing and production	Private
	Distributor/Suplyer	Manage products or raw materials to keep their condition stable	Private
	Tool making consultant	Consultant for prototype equipment or pilot plant	Private

1. Able to work professionally in their field by always applying conservation values and Indonesian insights to provide good for society and the environment.
2. Able to work and develop themselves in professions related to the chemical engineering industry (engineers, managers, process/chemical product consultants), researchers, educators, technopreneurs, or others by applying chemical engineering science and other supporting knowledge
3. Can communicate well and play an effective role in the work environment both when working independently and when being a member or leader in a team.

The field of chemical engineering is closely related to engineering process. Today, chemical engineering alum is not concentrated in the field of chemical processes. Many chemical engineering alumni have ventured into banking and entrepreneurship. Basically, the chemical engineering curriculum itself is structured to produce a chemical engineering process engineer who is reliable in terms of design, evaluation, economics, to management. The demands of the times that are so fast cause chemical engineering alumni to experience differentiation in terms of career choices both for economic reasons, opportunities, and ideals.

The fields of work that alumni are interested in are also varied. The industrial sector is still the largest in terms of oil and gas, petrochemicals, and food. The fields of banking and entrepreneurship, which reached 10% and 8% respectively, require special attention. The chemical engineering course is considered sufficient to provide insight into the two fields, namely technopreneurship and the economic evaluation of chemical plants.

With a relatively short waiting period, UNNES chemical engineering alumni have a fairly varied career distribution where private industry and state-owned enterprises are still dominant. The percentage of 17% for multinational companies / industries shows that chemical engineering graduates are able to compete to penetrate companies with a fairly high level of competition.

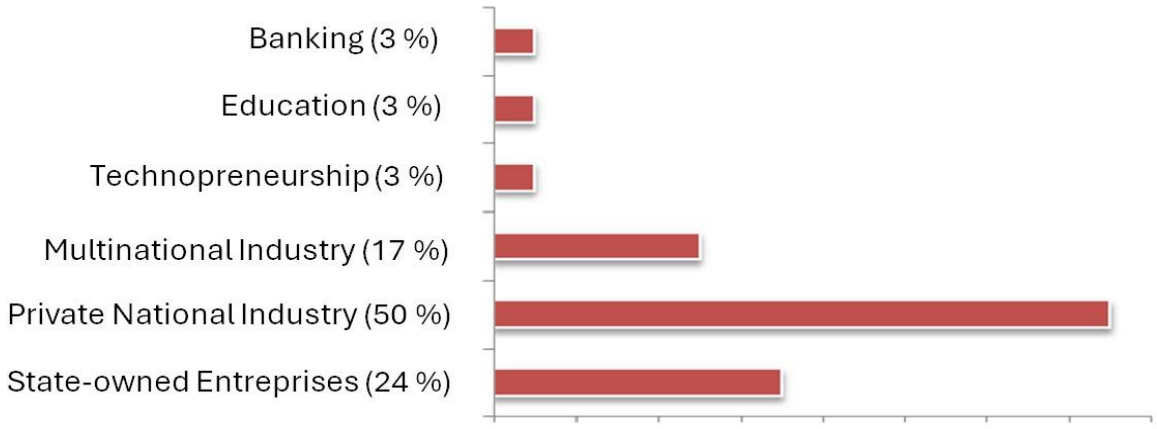


Figure 5.1. Alumni career distribution

VI. Learning Outcomes Formulation for Graduates of Study Programs

Table 6.1. Results of PLO Mapping Chemical Engineering Undergraduate Program Based on Competence

Competence	PLO	PLO Code
Student Understanding	Attitude Knowledge General Skills Special skill	S2, S4, S5 P1, P2, P3, P4 KU1, KU2, KU3, KU5 KK1, KK2, KK3, KK4, KK5, KK6
Educational Learning	Attitude Knowledge General Skills Special skill	S2, S4, S5 P1, P2, P3, P4 KU1, KU2, KU3, KU4, KU5 KK1, KK2, KK3, KK4, KK5, KK6
Mastery of the field of science and/or expertise	Attitude Knowledge General Skills Special skill	S2, S4, S5 P1, P2, P4 KU1, KU2, KU3, KU5 KK1, KK2, KK3, KK4, KK5, KK6
Personality	Attitude Knowledge General Skills Special skill	S1, S2, S3, S4, S5, S6

Table 6.2. Learning Outcomes of Chemical Engineering Undergraduate Study Program

PLO Element	PLO Code	PLO Code
Attitude	S1	Fear God Almighty;
	S2	Have good morals, ethics, and personality in completing their duties;
	S3	Act as a proud citizen and love the homeland, and support world peace;
	S4	Able to work together and have social sensitivity and high concern for society and the environment;
	S5	Appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others;
	S6	Uphold law enforcement and have the spirit to put the interests of the nation and the wider community first.
Knowledge	P1	Mastering the theoretical concepts of natural science, engineering mathematics applications; engineering principles, engineering science and engineering design needed for the analysis and design of processes, processing systems, and equipment needed to convert raw materials into products that have added value;
	P2	Mastering the principles and techniques of process design, processing systems, and equipment needed to convert raw

PLO Element	PLO Code	PLO Code
	P3	materials into products that have added value;
	P4	Mastering the latest principles and issues in economics, social, ecology in general; Mastering knowledge of communication techniques and the latest and latest technological developments in accordance with industry 4.0
General skills	KU1	Applying logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and/or technology in accordance with the field of chemical engineering;
	KU2	Reviewing the implications of developing or implementing science, technology or art in accordance with their expertise based on scientific principles, procedures and ethics to produce solutions, ideas, designs, or art criticism and compiling a scientific description of the results of the study in the form of a thesis or final project report;
	KU3	Making the right decisions in the context of solving problems in the field of chemical engineering, based on the results of the analysis of information and data;
	KU4	Manage learning independently;
	KU5	Develop and maintain a network with mentors, colleagues, peers both inside and outside the institution.
Special skill	KK1	Able to apply mathematics, science, and engineering principles to solve complex engineering problems in processes, processing systems, and equipment needed to convert natural materials into products that have added value (through physical, chemical and/or biological processes);
	KK2	Able to find sources of engineering problems in processes, processing systems, and equipment needed to convert raw materials into products that have added value through the process of identification, analysis, interpretation of data and information based on sustainable engineering principles and with a conservation perspective.
	KK3	Able to conduct research which includes identification, formulation and analysis of engineering problems in processes, processing systems, and equipment needed to convert natural materials into products that have added value;
	KK4	Able to formulate alternative solutions to solve complex engineering problems in processes, processing systems, and equipment needed to convert natural materials into products that have added value by taking into account economic factors, public health and safety, cultural, social

PLO Element	PLO Code	PLO Code
		and environmental (environmental considerations);
	KK5	Able to design processes, processing systems, and equipment needed to convert natural materials into products that have added value with an analytical approach and consider technical standards, performance aspects, ease of application, sustainability, and pay attention to economic factors, public health and safety, cultural , social and environmental;
	KK6	Able to select resources and utilize appropriate engineering design and analysis tools based on information technology and computing to carry out engineering activities in the fields of processes, processing systems, and equipment needed to convert natural materials into products that have added value.

VII. Determination of Study Materials based on PLO

Table 7.1. Mapping Results of Study Materials Based on PLO Chemical Engineering Undergraduate Program

PLO Code	Study Material	BK Code
P1, KU1, KK1	Calculus	BK 1
P1, KU1, KK1	Physics	BK 2
P1, KU1, KK1	Chemistry	BK 3
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	Basic Science of Chemical Engineering	BK 4
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	Process Engineering	BK 5
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	Operation Unit	BK 6
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	Design Engineering	BK 7
S2, S4, P3, P4, KK5	Management and Entrepreneurship	BK 8
KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	Knowledge of Supporting Techniques and Specific Themes (Sustainable Development Goals)	BK 9
S2, S4, P4, KK5	Ethics and Profession	BK 10
P1, P2, KU1, KU2, KU3, KK1, KK2, KK3, KK4, KK5	Lab and Research	BK 11

PLO Code	Study Material	BK Code
S1, S2, S3, S4, S5, S6	Pancasila and Civil Education	BK 12
S1, S2, S3, S4, S5, S6	Religion Education	BK 13
S2, S4, S5, P3, KU1, KU2, KK2	Conservation	BK 14
S2, S4, S5, P4	Language	BK 15
S2, S3, S4, S5, S6, P3, P4, KU5, KK6	Information Technology	BK 16

Table 7.2. Relationship Matrix between PLO and Study Materials

No.	PLO Code	STUDY MATERIAL															
		BK 1	BK 2	BK 3	BK 4	BK 5	BK 6	BK 7	BK 8	BK 9	BK10	BK11	BK12	BK1 3	BK14	BK 15	BK 16
ATTITUDE (S)																	
1	S1												√	√			
2	S2												√	√			
3	S3												√	√			
4	S4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
5	S5													√			
6	S6												√				
KNOWLEDGE (P)																	
7	P1	√	√	√	√	√	√	√				√					
8	P2				√	√	√	√		√		√					
9	P3								√				√	√	√		
10	P4								√		√					√	√
GENERAL SKILL (KU)																	
11	KU1	√	√	√	√	√	√	√	√	√		√					
12	KU2	√	√	√	√	√	√	√	√	√		√					
13	KU3	√	√	√	√	√	√	√	√	√		√					
14	KU4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
15	KU5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
SPECIAL SKILL (KK)																	
16	KK1				√	√	√	√				√					
17	KK2				√	√	√	√				√					
18	KK3											√					
19	KK4				√	√	√	√				√					
20	KK5				√	√	√	√				√					

21	KK6				√	√	√	√				√					

VIII. Study Materials and Courses

Table 8.1. Mapping Results of Study Materials and Subjects for Chemical Engineering Undergraduate Program Based on PLO

PLO Code	BK Code	Forms of Learning (credits*)			credits *	Course
		T	S	P/L		
P1, KU1, KK1	BK 1	√				Calculus I, Calculus II, Statistics
P1, KU1, KK1	BK 2	√				Physics
P1, KU1, KK1	BK 3	√				Analytical Chemistry, Organic Chemistry, Chemistry, Physical Chemistry, Chemical Analysis and Instrumentation
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	BK 4	√				Chemical Engineering Mathematics I, Chemical Engineering Mathematics II, Mass Balance, Energy Balance, Chemical Engineering Thermodynamics 1, Chemical Engineering Thermodynamics 2, Chemical Reaction Engineering, Fluid Transport Processes, Transport Phenomena, Heat Transfer, Reactors, Synthesis and Process Simulation, Engineering Computing, Chemical Engineering Economics
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	BK 5	√				Bioresources Engineering, Chemical Industry Process, Construction Materials and Corrosion, Bioprocess Technology, Product Technology, Process Control
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	BK 6	√				Mechanical Operation, Diffusional Thermal Separation, Multistage Separation Operation
P1, P2, KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	BK 7	√				Process Equipment Design I, Process Equipment Design II, Preliminary Chemical Plant Design,
S2, S4, P3, P4, KK5	BK 8	√				Technopreneurship
KU1, KU2, KU3, KU4, KK1, KK2, KK3, KK4, KK5	BK 9	√		√		Chemical Utility Systems, Industrial Waste Treatmentt, Occupational Safety, Bioethanol, Thermal Conservation Technology, Extraction of Biomass, Biomaterial, Biodiesel, Petrochemicals and Petroleum, Advanced Simulation, Chemical Engineering Process Management, Biofertilizer

PLO Code	BK Code	Forms of Learning (credits*)			credits *	Course
		T	S	P/L		
						& Pesticide, Supercritical Extraction Technology, Plasma & Ozone Technology, Management and Energy Conservation, Bioseparation, Basic Food Science, Industrial Microbiology, Bioprocess Engineering, Food Industry Processes, Biogas, Industrial Field Trip, Community Service Program, Field Practice
S2, S4, P4, KK5	BK 10	√				Industrial Management and Engineering Ethics
P1, P2, KU1, KU2, KU3, KK1, KK2, KK3, KK4, KK5	BK 11	√		√		Research Methodology, Analytical Chemistry Lab, Organic Chemistry Lab, Bioprocess Lab, Chemical Engineering Lab I, Chemical Engineering Lab II, Research Task
S1, S2, S3, S4, S5, S6	BK 12	√				Pancasila Education, Civil Education
S1, S2, S3, S4, S5, S6	BK 13	√				Islamic Religion Education, Christian Religion Education, Education, Catholic Religion, Hindu Religion Education, Buddhist Education, Confucian Religion Education
S2, S4, S5, P3, KU1, KU2, KK2	BK 14	√				Conservation Education
S2, S4, S5, P4	BK 15	√				Indonesian language, English
S2, S3, S4, S5, S6, P3, P4, KU5, KK6	BK 16	√				Digital Literation and Humanity

The matrix above has an important meaning for lecturers when developing RPS so that each lecturer does not use his own reasoning when writing PLO and becomes a lecturer reference for developing course learning outcomes (CLO) and sub-CLO.

IX. Distribution of Courses and Weight of Credit in the Curriculum Structure and Curriculum Map

The composition of the courses that have been determined is then structured in semesters I to VIII. This stage is arranging the courses into semesters. Pay attention to the provisions for the distribution of courses as follows:

1) Semesters 1-5 contain compulsory study programs, MKU or MKDK outside of PLP/PKL, KKN and Thesis/TA with a total of 110 credits offered or an average of 22 credits/semester. General Courses (MKU) consist of General Compulsory Courses (MKWU) and MKU UNNES. MKWU covers Religious Education, Pancasila Education, Citizenship Education, and Indonesian Language. MKU UNNES covers Conservation Education and Digital and Humanitarian Literacy. MKDK includes courses in Introduction to Education, School Management, Educational Psychology and Counseling Guidance. MKU is a subject that must be taken by students of education and non-education study programs. MKDK is a compulsory subject for education students. The management of MKU is at the university, namely by Development Center MKU-MKDK, Curriculum, and Learning Innovation, LP3 UNNES. MKU or MKDK placements are in semesters 1-5 with the following conditions:

MKU Placement

FACULTY	ODD SEMESTER	EVEN SEMESTER
FBS, FIS, FIK, FE	Pancasila Education	Religion Education
	Civil education	Indonesian Language
	Conservation Education	Digital Literation and Humanity
FIP, FMIPA, FT, FH	Religion Education	Pancasila Education
	Indonesian Language	Civil Education
	Digital Literation and Humanity	Conservation Education

Placement of MKDK Education Study Program

FACULTY	ODD SEMESTER	EVEN SEMESTER
FBS, FIS, FIK, FE	Introduction to Education	School Management
	Educational Psychology	Counseling guidance
FIP, FMIPA, FT, FH	School Management	Introduction to Education

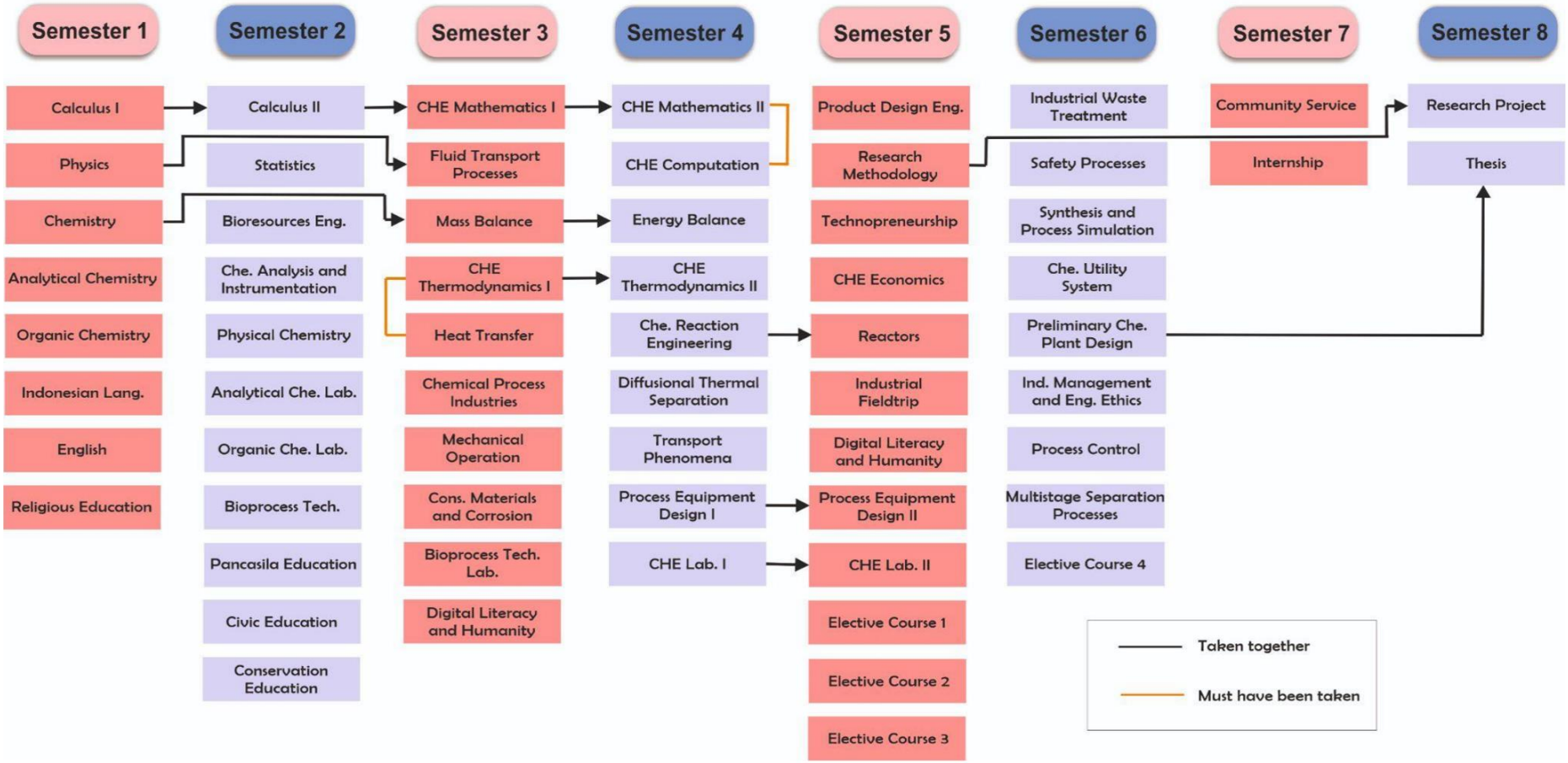
	Counseling guidance	Educational Psychology

The forms of learning activities that are commonly carried out in study programs are learning process activities, structured assignment activities, independent activities, seminars, laboratory practicum, studio practice, workshop practice. But it does not rule out the possibility of activities such as projects/independent studies, research/research, design, development, entrepreneurship or forms of community service. All depend on the PLO and the results of curriculum evaluations that require refinement or review. For example, the results of an analysis of the PLO of a study program apparently require students to be skilled in applying entrepreneurial knowledge so that they design entrepreneurial learning activities equivalent to 1 credit in addition to entrepreneurship lecture activities equivalent to 2 credits so that the entrepreneurship education course is then given a weight of 3 credits.

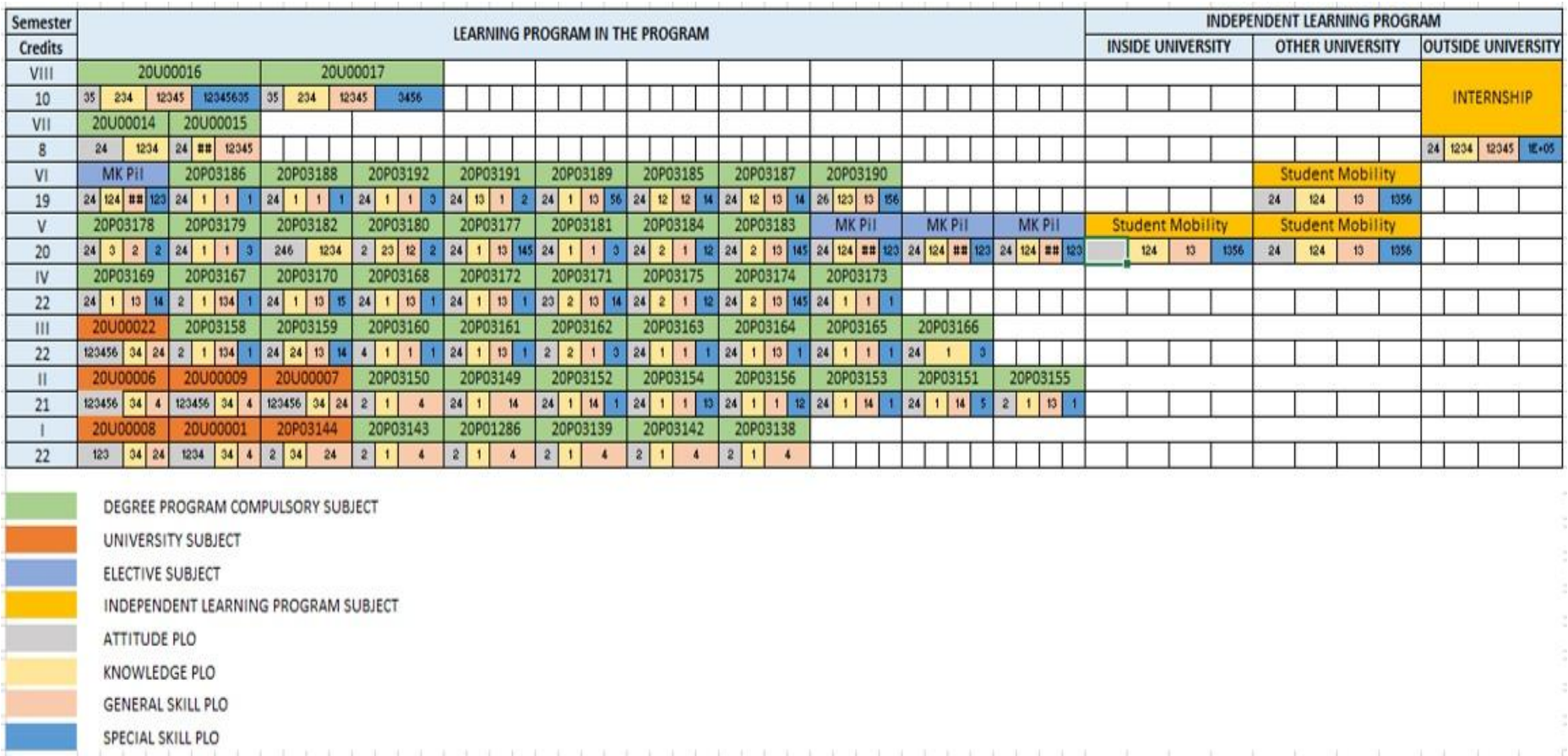
2) Semester 6 contains elective courses (MKPil) and study program development courses (MKPP) with a total of 20 credits. The two groups of subjects can be taken by students outside the study program at UNNES and students from similar and different study programs outside UNNES. The courses provided still refer to the needs of PLO according to the graduate profile. The optional MK is developed so that graduates have additional abilities according to their profile. MKPP is a compulsory subject developed according to the agreement of the study program association and the learning is carried out online. Between LPTKs throughout Indonesia have agreed to give each study program the task of developing 3 study program development courses and carried out online. Study materials in MKPP developed by study programs should refer to the superiority of study programs resources so that they have a bargaining value for similar/different study programs both inside and outside UNNES. Management of taking courses is regulated using a quota of the number of students taking into account study program resources or designed in a massive open online course (MOOC) which allows free from quota problems. The forms of student learning activities that can be carried out are in addition to the learning process, structured assignment activities, and independent activities as well as student exchanges, entrepreneurial activities, independent projects, humanitarian projects, and even teaching assistance in educational units (not equivalent to PLP but can be equivalent to certain courses). in study program) for non-educational students.
3) Semester 7 and 8 students are directed to carry out learning activities outside the study program outside UNNES. Semester 7 contains PLP/PKL and KKN courses (@4 credits) and semester 8 contains thesis/TA courses (6 credits). The forms of student activities that can be designed are internships/work practices that can be equivalent to PKL, teaching assistance in educational units that can be equivalent to PLP, conducting humanitarian projects or building villages/conducting thematic real work courses that can be equivalent to KKN courses according to UNNES provisions. . In this 7th semester -while carrying out these activities- it is also possible for students to carry out independent study/project activities or scientific research/research whose results can be written as a thesis/TA. It is highly recommended that such integrated activities can be designed by the study

program.

Curriculum Map



KPT Curriculum Map 2020



LIST OF STUDY CURRICULUM STRUCTURE

Study Program Name : Chemical Engineering
Department : Chemical Engineering
Faculty : Engineering
Degree : Undergraduate

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
Semester 1																				
1	20P01286	Physics	4	T	√								√	√				W	42126, 22262	
2	20P03138	Organic Chemistry	3	T	√								√	√				W	40759, 41901	
3	20P03139	Chemistry	3	T	√								√	√				W	40770, 42134	
4	20P03142	Analytical Chemistry	3	T	√								√	√				W	40767, 40946	
5	20P03143	Calculus I	3	T	√								√	√				W	40943, 42040	
6	20U00008	Indonesian Language	2	T	√									√				W		
7	20P03144	English	2	T	√									√				W		
8	20U00023	Religion Education	2	T		√								√				W		
9	20U00002	Christian education	2	T		√								√				W		
10	20U00003	Hindu Religion Education	2	T		√								√				W		

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
11	20U00004	Buddhist Education	2	T		√								√				W		
12	20U00001	Islamic education	2	T		√								√				W		
13	20U00005	Confucian Religion Education	2	T		√								√				W		
Total			22																	
Semester 2																				
14	20P03149	Physical Chemistry	2	T		√							√	√				W	40770, 22262	
15	20P03150	Calculus II	2	T		√							√	√				W	40767, 42040	
16	20P03151	Bioresource Engineering	3	T		√							√					W	40767, 40759	
17	20P03152	Chemical Analysis and Instrumentation	2	T		√							√	√				W	41901, 42134	
18	20P03153	Statistics	2	T		√							√	√				W	41901, 40767	
19	20P03155	Bioprocess Technology	2	T		√							√					W	40946, 22262	
20	20P03154	Analytical Chemistry Lab	1	p		√							√					W	41901, 40767	
21	20P03156	Organic Chemistry Lab	1	p		√							√					W	42901, 42134	

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
22	20U00009	Civil Education	2	T		√								√				W		
23	20U00006	Pancasila Education	2	T		√								√				W		
24	20U00007	Conservation Education	2	T		√								√				W		
Total			21																	
Semester 3																				
25	20P03158	Chemical Engineering Mathematics I	3	T			√						√	√				W	40946, 41896	Calculus I Calculus II
26	20P03159	Fluid Transport Processes	2	T			√						√					W	40782, 21944	Physics
27	20P03160	Mass Balance	3	T			√						√					W	40759, 40770	Chemistry
28	20P03161	Chemical Engineering Thermodynamics I	2	T			√						√					W	40749, 42045	Calculus I Calculus II
29	20P03162	Chemical Process Industries	3	T			√						√					W	40782, 42040	
30	20P03163	Construction Materials and Corrosion	2	T			√						√	√				W	40749, 22262	
31	20P03164	Heat Transfer	2	T			√						√					W	40943, 40749	Chemical Engineering

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
																				Thermodynamics I
32	20P03165	Mechanical Operation	2	T			√						√					W	41901, 22188	
33	20P03166	Bioprocess Technology Lab	1	P			√						√					W	40946, 22262	
34	20U00022	Digital Literation and Humanity	2	T			√							√				W	42126	
Total			22																	
Semester 4																				
35	20P03167	Chemical Engineering Mathematics II	3	T				√					√					W	40946, 41896	Chemical Engineering Mathematics I
36	20P03168	Energy Balance	2	T				√					√					W	42045, 22262	Mass Balance
37	20P03169	Chemical Reaction Engineering	3	T				√					√					W	40770, 40943	Physical Chemistry
38	20P03170	Chemical Engineering Computation	2	T				√					√					W	41896, 21944	
39	20P03171	Diffusional Thermal Separation	2	T				√					√		√			W	21944, 42134	

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
40	20P03172	Chemical Engineering Thermodynamics II	3	T				√					√					W	42045, 40749	Chemical Engineering Thermodynamics I
41	20P03173	Transport Phenomena	3	T				√					√					W	21944, 42134	
42	20P03174	Process Equipment Design I	3	T				√					√		√			W	40749, 42045	
43	20P03175	Chemical Engineering Lab I	1	P				√					√		√			W	41896, 42045	
Total			22																	
Semester 5																				
44	20P03177	Reactors	3	T					√				√		√			W	40943, 22262	Chemical Reaction Engineering
45	20P03178	Research methodology	2	T					√				√		√		√	W	40770, 40759	
46	20P03179	Technopreneurship	2	T					√				√		√		√	W	40767, 22188	
47	20P03180	Product Design Engineering	2	T					√				√		√		√	W	40946, 40782	
48	20P03181	Chemical Engineering Economics	2	T					√				√		√		√	W	40946, 22188	
49	20P03182	Industrial Fieldtrip	0	L					√						√		√	W		

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
50	20P03183	Process Equipment Design II	2	T					√				√		√			W	40782, 42134	
51	20P03184	Chemical Engineering Lab II	1	P					√				√		√			W	42045, 22188	
		Option 1	2	T					√				√		√		√	Pi		
		Option 2	2	T					√				√		√		√	Pi		
		Option 3	2	T					√				√		√		√	Pi		
Total			20																	
Semester 6																				
52	20P03185	Multistage Separation Process	2	T					√				√					W	40782, 21944	
53	20P03186	Safety Processes	2	T					√				√				√	W	40770, 22188	
54	20P03187	Process Control	2	T					√				√					W	40946, 21944	
55	20P03188	Industrial Waste Treatment	2	T					√				√				√	W	40770, 22188	
56	20P03189	Synthesis and Process Simulation	2	T					√				√					W	42045, 21944	

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
57	20P03190	Preliminary Chemical Plant Design	3	T						√			√					W	41896, 42045	
58	20P03191	Chemical Utility Systems	2	T						√			√				√	W	40943, 21944	
59	20P03192	Industrial Management and Engineering Ethics	2	T						√			√				√	W	40767, 42126	
		Option 4	2	T						√			√				√	Pi		
Total			19																	
Semester 7																				
60	20U00014	Community Service Program	4	L							√						√	W		
61	20U00015	Field practice	4	L							√						√	W		
Total			8																	
Semester 8																				
62	20U00017	Research Task	4	P								√	√		√	√	√	W		
63	20U00016	Thesis	6	L								√	√					W		
Total			10																	
Elective courses or study program development (MKPP)																				

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
64	20P03273	Bioethanol	2	T									√		√	√	√	Pi	40943	
65	20P03274	Biomass thermal conversion technology	2	T									√		√		√	Pi	40749, 40770	
66	20P03275	Biomass Extraction	2	T									√		√		√	Pi	40943, 40767	
67	20P03276	Biomaterial	2	T									√		√		√	Pi	42134, 40770	
68	20P03277	Advanced Simulation	2	T									√		√		√	Pi	41896, 21944	
69	20P03278	Petroleum and Petrochemical Technology	2	T									√		√	√	√	Pi	40782, 40759	
70	20P03279	Chemical Engineering Process Management	2	T									√				√	Pi	41896, 21944	
71	20P03280	Biofertilizer and Pesticide	2	T									√			√	√	Pi	40782, 40759	
72	20P03281	Supercritical Extraction Technology	2	T									√		√		√	Pi	42045, 42040	
73	20P03282	Plasma and Ozone Technology	2	T									√		√		√	Pi	42040	

NO	Course Code	COURSE	credits	Forms of activity	Smt								Activity Locus					W/Pi	Responsible Lecturer Code	Prerequisite Course
					1	2	3	4	5	6	7	8	A	B	C	D	E			
74	20P03283	Management and Conservation of Energy	2	T									√			√	√	Pi	42045, 22188	
75	20P03284	Bioseparation	2	T									√		√		√	Pi	22188, 42126	
76	20P03285	Basic Food Science	2	T									√	√		√	√	Pi	22262, 41901	
77	20P03286	Industrial Microbiology	2	T									√	√	√	√	√	Pi	40946, 22262	
78	20P03287	Bioprocess Engineering	2	T									√			√	√	Pi	40946, 22262, 41901	
79	20P03288	Food Industry Process	2	T									√			√	√	Pi	22262, 41901	

Description

Form of Activity : (A) lectures, responses, tutorials; (B) seminars or the like; (C) practicum, studio practice, workshop practice, field practice, work practice, research/research, design, or development, military training, student exchange, internship, entrepreneurship, and/or community service. Because each study program has different characteristics, please identify the form of activity for each study program. Study programs can also fill in the code in the column, for example: lectures are coded 1 or ….., responses are coded 2 or …..

Activity Locus : A: in the original study program, B: outside the study program within UNNES, C: in a similar study program outside UNNES, D: in a different study program outside UNNES, E: in non-University institutions

W/Pi : W compulsory course, Pi elective courses

Prerequisite courses: course codes that must be followed before.

Elective courses or study program development courses (MKPP) are courses outside the mandatory 110 credits (smt 1-5) and 14 credits (PLP/PKL, KKN, Thesis/TA), namely 20 credits – 36 credits that can be taken in the original study program, outside the original study program within UNNES, in similar/different study programs outside UNNES, and non-university institutions. The elective courses provided are 5 times the number of credits that must be taken. Study program development courses contain at least 3 courses that are designed according to an agreement with the association (association assignments) and the learning is carried out online.

X. Course Description

Serial number	Code	Course Name	Description
1	20P01286	Physics	This course discusses quantities and dimensions, one-dimensional motion, two-dimensional motion, dynamics, work and energy, linear momentum and collisions, rotation, and fluid mechanics.
2	20P03138	Organic Chemistry	This course discusses structural isomers and compounds of alkanes, alkyl halides, alkenes and alkynes, amines, alcohols and ethers, carboxylic acids and their derivatives, carbohydrates, lipids-fats, amino acids - proteins.
3	20P03139	Chemistry	This course discusses the basic concepts of chemical engineering which include Atomic Structure, SPU, Molecular Structure, Chemical Bonds, Forms of Substances, Solutions, Stoichiometry, Redox and Electrochemistry, and Complex Chemistry.
4	20P03142	Analytical Chemistry	This course contains a discussion of the qualitative and quantitative concept chemical analysis and its instrumentation. The materials studied in this course are: identification of anions and cations, titrimetry, acidi-alkalimetry, iodo-iodimetry, permanganometry, argentometry, chromatography, and spectrophotometry.
5	20P03143	Calculus I	This course discusses the basic concepts of functions, limits, infinite series, derivatives, partial derivatives, integration methods.
6	20U00008	Indonesian Language	This course contains a discussion of the function and position of the Indonesian language, Variety of Indonesian languages, Indonesian language scientifically, Standard Indonesian, Types of essays, Writing articles, Writing scientific papers, Themes, topics, and titles of essays, Organization of essay content, Types and development of paragraphs , Effective sentences, Sentence structure, Spelling, vocabulary, and writing format, References and writing a bibliography.
7	20P03144	English	This course discusses grammar, structure, and vocabulary as well as their applications in writing, reading, and listening.

8	20U00023	Catholic Religion Education	This course discusses religious values in Catholicism
9	20U00002	Christian Religion Education	This course discusses religious values in Christianity
10	20U00003	Hindu Religion Education	This course discusses religious values in Hinduism
11	20U00004	Buddhist Education	This course discusses religious values in Buddhism
12	20U00001	Islamic education	This course discusses faith, human concepts, Islamic law, morality in Islam, society and politics in Islam, Islamic science and technology, safety of the whole word, law of Islam.
13	20U00005	Confucian Religion Education	This course discusses religious values in the Confucian Religion
14	20P03149	Physical Chemistry	This course contains a discussion of physical and chemical equilibrium, thermochemistry, phase rules, colligative properties of solutions, electrolyte solutions and the basics of colloid chemistry, concepts about thermodynamic quantities, basic laws of equilibrium phase and equilibrium phase of ideal systems, approaches equilibrium of non-ideal systems by means of the fugacity coefficient and the activity coefficient.
15	20P03150	Calculus II	This course is an introduction and at the same time calculates chemical engineering applications with material in the form of infinite series, partial derivatives, folding integrals and their use, the basics of linear and vector algebra, and ordinar differential equations with their solutions.
16	20P03151	Bioresources Engineering	This course contains a discussion of the processes and methods of taking, processing and improving the quality, as well as storing products based on Indonesian natural ingredients
17	20P03152	Chemical Analysis and Instrumentation	This course contains the basics of radiant energy theory, absorption of radiant energy, spectrophotometry, AAS, and chromatography.
18	20P03153	Statistics	This course discusses descriptive statistics, probability theory, probability distributions, sampling distributions, statistical parameters, hypothesis testing, empirical models, and experimental design.

19	20P03155	Bioprocess Technology	This course contains a discussion of the scope and definition of bioprocess technology, basics of microbiology, enzymes, microbial metabolism, microbial growth and product formation, bioreactors, product separation and purification, and the bioprocess industry.
20	20P03154	Analytical Chemistry Lab	This course contains a discussion of concepts about the application of analytical chemistry both qualitatively and quantitatively. The materials studied in this course are: identification of cations and anions, separation of group I cations, acidi-alkalimetry, and spectrophotometry.
21	20P03156	Organic Chemistry Lab	This Organic Chemistry Practicum course will learn the basics of organic reactions such as hydrolysis, acetylation, esterification, extraction isolation, enzymes and vitamins.
22	20U00009	Civil Education	This course contains discussions on human rights, rights and obligations of citizens, state defense, democracy, Archipelago insight, Archipelago insight and geopolitics, Implementation of archipelago insight, National security, Natural aspects in national defense, Social aspects in national resilience, Politics and national strategy, National development and management, National development planning, Implementation of national politics and strategies.
23	20U00006	Pancasila Education	This course discusses the background and objectives of Pancasila education, Pancasila in the historical perspective of the Indonesian struggle, the process of formulating and ratifying the Pancasila as the basis of the Republic of Indonesia, Pancasila as the basic pillars of social life, as a nation and state, Pancasila as the basis of the Unitary State of the Republic of Indonesia, Pancasila as an ideology. Pancasila as a political ethic, Pancasila as a national development paradigm, Actualization of Pancasila as a paradigm for the life of the Indonesian nation in the campus environment.
24	20U00007	Conservation Education	Courses on technological and socio-cultural conservation knowledge that are in line with UNNES conservation values.
25	20P03158	Chemical Engineering Mathematics I	This course studies the formulation of Chemical Engineering problems in the form of mathematical problems and their analytical solutions with materials including: Ordinary differential equations (PDO) with typical functions: Bessel series, legendre, beta function, gamma function, Laplace transformation, basic approaches mathematical chemical engineering, mass balance modeling, fluid flow in pipes, heat transfer, chemical reaction engineering, one-dimensional transfer processes, two- and three-dimensional transfers, solubility, distillation, and mixing processes.
26	20P03159	Fluid Transport Processes	This course contains a discussion of the definition and properties of fluids, fluid transportation equipment, mass balance (continuity equation), energy balance, quantitative discussion of fluid transportation equipment, fluid flow measurement tools, qualitative discussion of pumps, quantitative discussion of pumps, pump selection and design, compressor.
27	20P03160	Mass balance	This course contains a discussion of units and dimensions, Density, specific gravity, concentration, calculation basis, temperature, pressure, reaction equations & stoichiometry, mass balance, degrees of freedom, mass balance without chemical reaction, mass balance with chemical reaction, mass balance with recycle, bypass and purge system.

28	20P03161	Chemical Engineering Thermodynamics I	This course discusses the scope of thermodynamics, dimensions, units, measurements, temperature, pressure, work, energy, heat, Laws 1 and 2 as well as other basic concepts, equation of state (EoS), heat effect, entropy, work, refrigeration and liquefaction process.
29	20P03162	Chemical Process Industries	This course contains a discussion of the process of nitration, sulfonation, hydrogenation, halogenation, amination, esterification, alkylation, sulfuric acid industry, gas, cement, sugar, NaOH
30	20P03163	Construction Materials and Corrosion	This course contains a discussion of concepts regarding the selection of construction materials and their application in solving the problem of selecting materials for construction equipment in industry. The materials studied in this course are: introduction to materials science, atomic theory, bonds between atoms and molecules in materials, atomic structure in materials, crystal structures and defects, phase diagrams, ferrous metals and alloys, metal thermal processes, introduction to corrosion, types of corrosion, basic principles of corrosion control, corrosion prevention, and corrosion inhibitors.
31	20P03164	Heat Transfer	Discussion of the concept of the heat transfer process and its application in solving the problem of heat transfer in industrial equipment. The materials studied in this course are: the concept of heat transfer processes, conduction heat transfer, simultaneous conduction heat transfer with convection, convection heat transfer, radiant heat transfer, classification of heat exchangers, overall heat transfer coefficient, analysis of heat exchangers, tools cross and multiple cross heat exchangers, shell and tube heat exchangers.
32	20P03165	Bioprocess Technology Practicum	This course contains practicum on making microorganism growing media, microorganism growth, making nata de coco, VCO, solid state fermentation, yogurt.
33	20P03166	Mechanical Operation	This Mechanical Operations course contains materials for storing materials, solids transportation, screening, size reduction, size enlargement, sedimentation, centrifugation, filtration, cyclone, knockout drum, separator drum, thickener.
34	20U00022	Digital Literation and Humanity	This course provides knowledge and skills in using information media in cyberspace intelligently, wisely, and upholding human values, as well as being able to analyze the factors that support the formation of an information society in the 21st century.
35	20P03167	Chemical Engineering Mathematics II	This course contains a discussion on solving application problems in Chemical Engineering with the aid of programming with materials in the form of calculating chemical engineering tools, making modeling, calculating numerical analysis and solving with programming.
36	20P03168	Energy Balance	Discussion of basic concepts in energy balance calculations, energy balances without chemical reactions, calculation of enthalpy changes, energy balance applications without chemical reactions, energy balance calculations with chemical reactions, energy balances with chemical reaction effects, ideal processes, efficiency, and mechanical energy balances , heat of dissolution and mixing, moisture curve (psychrometric) and its use, as well as analysis of degrees of freedom in steady-state processes.

37	20P03169	Chemical Reaction Engineering	This course contains an explanation of the notion of reaction speed, Arrhenius reaction rate, finding reaction orders using integral and differential methods, multi-reaction mass balances, reaction kinetics with liquid-liquid, solid-liquid, and gas-liquid catalysts.
38	20P03170	Chemical Engineering Computation	This course discusses solving chemical engineering problems with numerical methods using computer assistance (Solver, Matlab, Hysis)
39	20P03171	Diffusional Thermal Separation	Theoretical and applied discussion of the basics of diffusional thermal separation, psychometric diagrams, humidification operations, dehumidification operations, drying, evaporation, crystallization, and absorption.
40	20P03172	Chemical Engineering Thermodynamics II	This course discusses the phase equilibrium of binary and multicomponent systems, the basic theory of solution applications in phase equilibrium, as well as mixing laws for ideal solutions.
41	20P03173	Transport Phenomena	This course studies the laws of conservation and velocity which are the principles of the process of transferring momentum, energy, and mass.
42	20P03174	Process Equipment Design I	The discussion of the basic concepts of designing chemical industrial equipment includes the design of vessels, storage devices, and heat exchangers. The materials studied in this course are: design codes and standards, as well as criteria and factors that influence vessel design, shell, bottom, roof design in flat-bottom cylindrical vessels, Comparison and Selection of Covers in Sealed Cylindrical Vessels, stress considerations) on Covered Cylindrical Vessels (Flate Plate, Conical, Elliptical, Torispherical, Hemispherical), Closed Cylindrical Vessel Design for External Pressure Operations, Vertical High Vessel Design and Supports, Horizontal Vessel Design with Saddle Support, flanges design, Introduction to Instrumentation and Engineering in Bulk Powder Properties, Hopper Design : Basic Theory, Flow Patterns, Curvature, Holes, Flow Rate, Segregation, Hopper Design : The Importance of Inlet and Outlet, Aeration and Without Aeration, Selection Criteria, Operational Aspects, Silo Design : Introduction, Silo Pressure , Basic Theory of Pressure in Silos, Changes in Pressure in Discharge of Solids, Silo Design : Structural Damage and Its Causes, Design Situation, Design of Heat Exchanger : Double Pipe Heat Exchanger, Design of Heat Exchanger : Shell-and-Tube Heat Exchanger.
43	20P03175	Chemical Engineering Lab I	Practicum to learn the basics of fluid flow, liquid-liquid extraction, size reduction, binary gas diffusion, mixing, and sedimentation
44	20P03177	Reactors	This course contains a discussion of the reactors types and simple designs of batch reactors, RAP, RATB, bubble reactors, reactors with stuffing materials.
45	20P03178	Research methodology	Discussion about the concept of research design, title selection, problem formulation, state of arts, research objectives, research benefits, hypotheses, research methods, research instrumentation, research data processing

46	20P03179	Technopreneurship	This course contains discussions on entrepreneurship, innovation, leadership, business planning, SWOT analysis, business opportunities in chemical engineering, successful entrepreneurial strategies, increasing productivity through motivation, sales, entrepreneurial ethics, and marketing plans.
47	20P03180	Product Design Engineering	This course contains a discussion of commodity and specialty products, emulsions, crystallins, products based on Renewable Natural Resources, innovations in motor vehicle mufflers, innovations in coffee cups, tablet detergent innovations, and innovations in milk concentration on farms.
48	20P03181	Chemical Engineering Economics	This course contains a discussion of Cash Flow Analysis regarding the time value of money, Capital, Interest: Nominal and effective interest, Equivalence, Compound interest formulas and factors, Arithmetic and geometric gradients, Investment Value Calculations: NPV, EUC, IRR, and B/C Ratio, Alternative selection, Independent alternative, Limited project selection, Replacement analysis, Depreciation & Tax, Investment Feasibility Evaluation (BEP)
49	20P03182	Industrial Fieldtrip	Industrial visits to learn about chemical industrial processes
50	20P03183	Process Equipment Design II	Discussion on the basics of inherently safer design, description and design of continuous distillation process, basic principles of continuous distillation, design variables in distillation, design method for binary system, general description of multicomponent distillation, design of multicomponent distillation column with short-cut method, design of distillation column multi-component with plate-to-plate and computer-aided method, batch distillation system design, plate efficiency, column size estimation, plate contractor, hydraulic plate design, stuffing column design.
51	20P03184	Chemical Engineering Lab II	Learn the basics of batch distillation, tray drying, solid-liquid reaction, vapor-liquid equilibrium, pump characteristics, and liquid-liquid equilibrium.
52	20P03185	Multistage Separation Processes	Theoretical discussion on the concept of stage wise contact and phase balance (vapor-liquid, liquid-liquid, and solid-liquid). Applicative discussion on flash distillation and partial condensation, distillation calculations using the mc chili-thiele method, distillation calculations using the ponchon-savarite method, liquid-liquid balance, single-stage extraction, multi-stage cross-current extraction, multi-stage counter-current extraction , solid-liquid extraction.
53	20P03186	Safety Processes	This course contains a discussion of the basics of K3 concepts, B3 hazards, failure hazards and accident prevention, K3 in confined spaces and labs, PPE, and K3 control strategies.
54	20P03187	Process Control	Theoretical and applied discussion regarding the benefits of control systems, design aspects of control systems, dynamic modeling, transfer function processes, dynamic behavior of chemical processes, working principles of measurement systems, controllers, and final control elements, reading of P&ID, dynamic behavior of feedback controlled processes, feedback system stability analysis, linear process frequency response analysis, control system design

55	20P03188	Industrial Waste Treatment	This course contains a discussion of the basics of Industrial Waste Management and waste characteristics, Industrial Waste Management liquid, solid, gas, adsorption, striper, removal of N2, phosphorus, oil
56	20P03189	Synthesis and Process Simulation	This course discusses the steps of synthesis and evaluation of chemical processes, balance concepts, and heat integration. The materials studied in this course are: chemical process synthesis, mass and energy balances in chemical processes, economic evaluation of chemical processes, integration of heat and power, process safety and waste management, management of output products and optimization of heat exchangers.
57	20P03190	Preliminary Chemical Plant Design	Discussion of the design strategy, plant site selection, plant layout, process selection, reactor selection, separator selection, heating network basics, mass balance and heat balance, application software (Chemcad) for chemical plant design, application software (Hysis) for chemical plant design, pre-process design calculations, and plant feasibility analysis.
58	20P03191	Chemical Utility Systems	This course discusses water supply and treatment units, both cooling water, boiler feed water and sanitation water, steam supply units, especially boilers, electricity supply units, compressed air supply units and refrigeration systems and waste treatment units.
59	20P03192	Industrial Management and Engineering Ethics	Discussion on leadership and power, motivation, decision making, conflict management, stress management, and quality standards and network planning, as well as technical ethics.
60	20U00014	Community Service Program	The application of the knowledge that has been obtained in the community as a form of community service.
61	20U00015	Field Practice	This course is carried out in industry for a certain period of time with the aim of studying the application of chemical engineering sciences to chemical processes in industry.
62	20U00016	Research Tasks	The application of chemical engineering science through the development and evaluation of theories based on experiments and/or simulations to produce research products that can benefit society.
63	20U00017	Thesis	Chemical Industry plan pre-design test results
64	20P03273	Bioethanol	Design of bioethanol production processes from generation to generation and biorefinery with one of its products bioethanol: Design of generation 1 bioethanol process; Process design for 2nd generation bioethanol based on bagasse; Chlorella-based 3rd generation bioethanol process design; Process design of 4th generation bioethanol based on agribusiness waste

65	20P03274	Biomass thermal conversion technology	Discussion on the characterization of biomass raw materials, conversion of biomass into activated carbon, conversion of biomass into bio-oil, extraction of phenolic compounds as the main component of bio-oil.
66	20P03275	Biomass Extraction	Extraction and mass transfer kinetics using conventional and modern methods (microwave assisted) in the extraction of pectin, essential oil, dyestuff, chitin etc.
67	20P03276	Biomaterials	This course discusses the history and definition of biomaterials, applications of biomaterials, principles and theories of kinetics and mechanisms of drug delivery systems, potential for biomaterial production from Indonesian natural materials, advanced technology in the field of biomaterials in Indonesia, and parameters and characterization of biomaterials.
68	20P03277	Advanced simulation	This course discusses the definition and application of CFD accompanied by phenomena equations. In addition, simulations will be carried out on various examples of cases in the world of chemical engineering such as fluid flow, separation, stirring, and combustion. After the simulation is done, the results from the simulation data will be interpreted into something that has a contribution to process optimization so that operating conditions can be recommended that support mass and energy conservation.
69	20P03278	Petroleum and Petrochemical Technology	Theoretical and applicable discussions regarding the history of petroleum, petroleum composition, petroleum formation, drilling and oil recovery, petroleum processing, petroleum product testing, petrochemical processes and history, petrochemical industry raw materials, petrochemical products, utilization of petrochemical products, synthetic gas line, ammonia and carbon black line, olefin line, aromatic line, and plastic processing industry.
70	20P03279	Chemical Engineering Process Management	This course deals with cost analysis in engineering decision making, aspects of complex project management and control. Engineering economics topics include cost estimation, time value of money, interest formulas and equivalence calculations, investment value measures, depreciation and income tax analysis. Engineering project management topics include knowledge of roles and responsibilities, planning, organization, time, cost, risk and quality management.
71	20P03280	Biofertilizer & Pesticide	This course discusses the history and definition of organic fertilizers and biopesticides, the advantages of organic fertilizers and biopesticides, sources for raw materials for organic fertilizers and biopesticides, types of organic fertilizers and biopesticides, simple formulations of organic fertilizers and biopesticides and ideas about advanced technology in the field of organic fertilizers and pesticides. biopesticides, application of organic fertilizers and biopesticides for organic farming, determination of the need for organic fertilizers and biopesticides on an agricultural land, and economic evaluation of the production of organic fertilizers and biopesticides on a small or medium industrial scale

72	20P03281	Supercritical Extraction Technology	This course discusses the extraction process that takes place at conditions around the critical point with material on basic principles, properties, process schemes, transfer phenomena (heat and mass), thermodynamic models, development, chemical reactions and their applications in the fields of energy, pharmaceuticals, natural products. , chemical and waste, and special applications.
73	20P03282	Plasma and Ozone Technology	Discussion of concepts on plasma and ozone technology which includes the classification of matter and material forms, plasma in human life, plasma, ozone and plasma generation technology, ozone technology in environmental conservation, and manufacture of ozonators.
74	20P03283	Management and Conservation of Energy	This course discusses energy management and conservation which is an important key in efforts to reduce environmental damage through optimizing energy use by increasing efficiency while saving energy use both on a small and large scale. This course material includes an overview of sustainability management and energy issues, development of national energy and its policies, energy and economy, energy and the environment, saving and optimizing fossil-based energy, development, production processes and optimization of renewable and nuclear energy, energy efficiency and its calculations on equipment systems. / simple and complex systems, evaluation of the energy economy on simple tools / systems, and energy audits, as well as visits to industry or energy producers / generators.
75	20P03284	Bioseparation	Theoretical discussion of the main process of bioseparation and its processing into other products that have added value such as water treatment, liquid waste treatment, and solid waste treatment
76	20P03285	Basic Food Science	This course contains the basic knowledge of food science which includes food chemistry, reactions in food, food analysis, food toxicology, and shelf life which are the basis for food processing in food science applications.
77	20P03286	Industrial Microbiology	This course discusses the application of bioprocess technology which is an important key in efforts to increase product selling value and reduce environmental damage through optimizing bioprocess technology by increasing efficiency on a small or large scale. This course material covers fermentation technology and solves various problems in various fields, namely: health, clothing, food, energy, security, environment and agriculture.
78	20P03287	Bioprocess Engineering	This course discusses the application of bioprocess technology which is an important key in efforts to increase product selling value and reduce environmental damage through optimizing bioprocess technology by increasing efficiency on a small or large scale. This course material includes fermentation technology, sterilization processes, Advances in Fermentation Technology, Fermentation Technology Prospecting on Bioreactors/Fermenters, Lactic Acid and Ethanol, Application of Fermentation Strategies for Improved Laccase Production and Fermentation Technology for Value Added Industrial Research.
79	20P03288	Food Industry Process	This course discusses the processes that occur in the food industry which includes the preparation process, food processing, food preservation processes, packaging processes, until the food ingredients are

			safe in the hands of consumers.

XI. Semester Lesson Plan

(contains all RPS from all subjects, both MKU, MKDK univ and study programs, MK scientific study programs (MKP), PLP, KKN, and Thesis / Final Project, and Study Program Development Courses). The RPS format can be downloaded on the BPM page according to the form FM-01-AKD-05 Rev. 05 Semester Learning Plan (RPS) – Rev 27 January 2020– **New**

Semester Lesson Plan Format (RPS)

UNNES	MINISTRY OF EDUCATION AND CULTURE **UNIVERSITAS NEGERI SEMARANG** Address : Building H, Sekaran Gunungpati Campus, Semarang 50229 Tel: (024) 8508092/93 Fax: (024) 8508093/850808, Website: www.unnes.ac.id – Email: rector@mail.unnes.ac.id **FORM** **SEMESTER LEARNING PLAN (RPS)**		
Document Number FM-02-AKD-05	**Revision Number** 05	**Page** 1of …	**Date of Issue** January 21st, 2020

Course :	**Semester :**	**credits :**	**Course Code :……..**
Study Program :	Supervisor / Responsible Lecturer :		
Approval	Supervisor Lecturer	Study Group Coordinator	Study program coordinator
	(signature)	If any (signature)	(signature)
Graduate Learning Outcomes (PLO)	**Attitude** CPL 1. CPL 2.		

	General Skills: CPL 3. **CP Special skill** CPL 4. **CP Knowledge** CPL 5.
Course Learning Outcomes (CLO)	CPMK 1. CPMK 2. CPMK 3. Etc.
Course Description	
Course References	1.

Meeting	**Expected ability**	**Learning materials**	**Forms of Learning; Learning methods; Learning Experience/Assignments**		**Assessment Techniques and Indicators**	**Assessment Weight**
			Face to Face (**TM**); Practicum (**PM**); Seminar (**S**); Practice (**P**); Field Practice (**PL**); Independent (**M**); Structured (**T**)	Time (minute)		
1	a. Determine the reaction mechanism based on the structure, reagents, reactants, and reaction conditions b. Skilled in making energy diagrams based on chemical computational data (CPMK 1, CPMK 2)	Determinants of the substitution and elimination reactions mechanism	**TM,** ***PJBL (Project based leaning)*** Students show creativity in preparing presentations, discussion activities. Utilize computational chemistry programs to optimize species in reaction models, create energy diagrams	**TM:** 2x50 **M :** 2x60 **T** : 2x60	**Techniques:** 1. Written Test 2. Structured Task Assessment **Indicator:** Can determine the reaction mechanism based on the structure, reagents, reagents, and reaction conditions, and their energetics	10

	c.					
	d.					

$$Final\ Score = \frac{(Daily\ Score\ Weight x Daily\ Score) + (Mid\ Semester\ Test\ Score\ Weight\ x Mid\ Semester\ Test\ Score) + (Final\ Score\ Weight x Final\ Score)}{Daily\ Score\ Weight + Mid\ Semester\ Test\ Score\ Weight + Final\ Score\ Weight}$$