

# STUDY PLAN GUIDEBOOK



**Ecopreneurship**  
**Growing with character**



**Undergraduate Programme in Chemistry Education**  
**Faculty of Mathematics and Natural Sciences**  
**Universitas Negeri Surabaya**  
**2020**

## General Remarks

To make it easier for students to prepare their study plans, the UPCE has developed a Study Plan Guidebook. This Study Plan (curricular map) include the compulsory courses, elective courses, internship, and the awarded Credit Semester Unit (in CU and ECTS).

Students can see the description of the Program Educational Objectives (PEOs) and Program Learning Outcomes (PLOs), that they will have after completing their undergraduate studies in the UPCE, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya. Students can also see in detail about their workload each semester, both in Credit Units (*sks*) and in ECTS. In addition, this Study Plan Guidebook can also direct academic advisor in monitoring students' study progress and students' achievement index achievement while studying in the UPCE, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya.

Hopefully this study plan can help students, especially in planning their studies as well as possible. In addition, it is hoped that this study plan will also help the improvement of the continuing higher education quality.

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# Chapter I. Introduction

Undergraduate Program in Chemistry Education (UPCE) which was established on July 31, 1984 with the Decree of the Director General of Higher Education Ministry of Education and Culture of the Republic of Indonesia No. 61 / DIKTI / Kep / 1984 has had 308 graduates in the last three years. This Undergraduate Program has had a National A accreditation certificate since 2010. The Undergraduate Program has proven its learning process with an appropriate curriculum to produce chemistry educators, researchers and / or entrepreneurs.

## Program Educational Objectives

To produce graduates with qualifications, the UPCE prepares a Program Education Objectives (PEO). PEO is the result of joint discussions and thoughts from the drafting team after reviewing a number of relevant documents and input from stakeholders. The PEO is structured to face the global challenges of graduates of Chemistry Education in the form of demands for the development and development of science and technology in the industry 4.0 era. Each PEO is expected to be understood and implemented by every chemistry graduate from Chemistry Department, FMIPA UNESA in teaching chemistry to their students, both in using ITE and in higher-order thinking. It is hoped that PEOs graduates of chemistry education will be able to become role models for especially the school community and the general public.

The Bachelor of Education in Chemistry (BEC) at the Faculty of Mathematics and Natural Sciences (FMNS), Universitas Negeri Surabaya (UNESA) is objected in order to prepare as teachers, managers of educational institutions, researchers, and entrepreneurs in national and global development with a title of Bachelor of Chemistry Education (S.Pd), who have:

- PEO-01: Mastering in the concepts of chemistry, chemistry learning, laboratory management, scientific methods and ICT and is able to apply them to problem solving in their work.
- PEO-02: A high-level thinking ability to communicate ideas verbally and in writing, ability to take the right initiatives and decisions, and lead working groups in relevant fields.
- PEO-03: Ability to collaborate, be honest, and be responsible for work in the field of expertise and entrepreneurship in the field of education that is environmentally friendly (green-education entrepreneurship).
- PEO-04: Capability to continue to develop and lifelong learning to continue education, both formal and informal
- PEO-05: Ability to develop and apply chemical competencies along with advances in science and technology and humanities values

The graduate profile and qualification of the Bachelor of Education in Chemistry, FMIPA UNESA was developed based on the National Standards for Higher Education (SN DIKTI) 2014, through the Grant for Program Learning Outcomes (PLO) from the Directorate of Learning and Student Affairs (the Directorate General of Higher Education, the Ministry of Research, Technology, and Higher Education) dated *Self Assessment Report for ASIIN Accreditation* December 31, 2016. The development activities started with PLO Workshop based on the Indonesian National Qualifications Framework (KKNI) and Outcome-Based Education (OBE), involving the management of the BEC, the management of PPG and Master of Education in Chemistry at FMIPA UNESA, students, education personnel, alumni, the results of treasure study, the report of School Field Program and users (schools).

Table 1. Relationship between PEOs of UPCE and the INQF

PLO vs INQF	Capable of apply science, technology, and art within his/her expertise and adaptable to various situations faced during solving a problem	Mastering in-depth general and specific theoretical concepts of certain knowledge and capable of formulating problem-solving procedure	Capable of taking strategic decision based on information and data analysis as well as providing direction in choosing several alternative solutions	Responsible for his/her own jobs and can be assigned to take responsibility of the attainment of organization's performances
PLO-1		√		
PLO-2	√			
PLO-3	√			
PLO-4	√			
PLO-5	√			
PLO-6		√		
PLO-7			√	
PLO-8				√

### Program Learning Objectives

Derived from the PEOs, the UPCE have 8 Program Learning Outcomes (PLOs). This PLOs consist of knowledge (cognitive), skills (psychomotor), and attitude (affective) as shown below.

The process of PLO formulation has considered input provided by stakeholders both internal and external stakeholders. Internal stakeholders consist of academic staff /lecturers and students, while external stakeholders consist of alumni, the Department of Education and the Indonesian Chemical Association (HKI) in the field of education. Stakeholder input on graduate profile based on scientific analysis and development skills, analysis of market needs and decision makers endorsed by Presidential Regulation Number 12 of 2012 concerning Higher Education, Presidential Regulation Number 8 of 2012 concerning the Indonesian National Qualification Framework (KKNI), Law of the Republic of Indonesia Number 14 of 2005 concerning Teachers and Lecturers. Minister of Higher Education and Technology Regulation No. 44 of 2015 concerning National Standards for Higher Education (SNPT). The results which are manifested in the form of PLOs, have been formulated as follows:

- PLO-1 Mastering chemical content both theoretical concepts about structure, dynamics, and energy, as well as the basic principles of separation, analysis, synthesis and characterization of chemicals.
- PLO-2 Mastering pedagogical knowledge of chemistry and applying it in designing, implementing, and evaluating learning.
- PLO-3 Mastering laboratory management based on the principles of Occupational Safety and Security (K3), managing the laboratory and using its equipment and how to operate chemical instruments.
- PLO-4 Being able to develop chemistry learning media by utilizing Information and Communication

- Technology (ICT).
- PLO-5 Applying the logical thinking, high-level thinking, critical, systematic and innovative in the context of the development or implementation of science, technology, and art that pays attention to and applies humanities in accordance with the field of chemistry education in solving problems.
- PLO-6 Mastering the basics of the scientific method, designing and carrying out research based on chemistry education, compiling scientific reports and communicating them both verbally and in writing by utilizing information and communication technology (ICT).
- PLO-7 Building cooperation and having entrepreneurial skills that are environmentally sound.
- PLO-8 Being able to adapt to various developments in chemistry, continuing to develop and learning throughout life to continue education, both formal and informal.

Regarding to the aspects of connection between PLO and PEO, Table 2 gives an overview how strong each of PLOs supports the PEO.

Table 2. Correlation between Objectives and the Program Learning Outcomes of UPCE

	PEO 01	PEO 02	PEO 03	PEO 04	PEO 05
PLO-1	S	NS	NS	NS	S
PLO-2	S	NS	NS	NS	S
PLO-3	S	NS	NS	NS	S
PLO -4	NS	S	NS	NS	S
PLO -5	NS	S	NS	NS	S
PLO -6	S	S	NS	NS	NS
PLO -7	NS	NS	S	NS	S
PLO -8	NS	NS	NS	S	S

S-Strong, NS-Not Strong

Table 3. Program Learning Outcome (PLO) vs the 6<sup>th</sup> level (the level for bachelor education) of the Indonesian National Qualification Framework (INQF)

PLO vs INQF	Capable of apply science, technology, and art within his/her expertise and adaptable to various situations faced during solving a problem	Mastering in-depth general and specific theoretical concepts of certain knowledge and capable of formulating problem-solving procedure	Capable of taking strategic decision based on information and data analysis as well as providing direction in choosing several alternative solutions	Responsible for his/her own jobs and can be assigned to take responsibility of the attainment of organization's performances
PLO-1		√		
PLO-2	√			
PLO-3	√			
PLO-4	√			

PLO vs INQF	Capable of apply science, technology, and art within his/her expertise and adaptable to various situations faced during solving a problem	Mastering in-depth general and specific theoretical concepts of certain knowledge and capable of formulating problem-solving procedure	Capable of taking strategic decision based on information and data analysis as well as providing direction in choosing several alternative solutions	Responsible for his/her own jobs and can be assigned to take responsibility of the attainment of organization's performances
PLO-5	√			
PLO-6		√		
PLO-7			√	
PLO-8				√

Based on Table 3, the PLO has been formulated in accordance with the level 6 minimum competency standards possessed by undergraduate. All PLO that have been formulated are accommodated in courses. At the end of each semester, an evaluation of the achievement of PLO is carried out and analyzed. The results of the analysis are used for further development of the PLO.

Table 1. Program Learning Outcome (PLO) vs Subject Specific Criteria (SSC) ASIIN

Subject Specific Criteria (SSC)	PLO							
	1	2	3	4	5	6	7	8
Specialist competences								
1. have gained chemistry-relevant fundamental knowledge of mathematics and the natural sciences,	√							
2. have sound knowledge of the core subjects of chemistry including inorganic, organic and physical chemistry, as well as of analytical chemistry,	√							
3. have gained knowledge in one or several other special areas in the natural sciences or humanities,					√			
4. are able to carry out practical chemistry work and have learnt how to handle chemicals independently and safely in lab practicals,			√					
5. have knowledge of safety and environmental issues and the legal fundamentals,			√					
6. have gained methodological competence in chemistry and are able to apply this in other contexts, and						√		
7. have interdisciplinary knowledge and skills, such as in economics, ethics or philosophy.							√	
8. obtain, interpret and evaluate data of scientific and technical relevance, and to draw sound conclusions, which take into account scientific, technological and ethical findings,						√		

Subject Specific Criteria (SSC)	PLO							
	1	2	3	4	5	6	7	8
9. solve problems of a scientific/application-oriented nature independently, and to present the results, as well as						√		
10. pursue lifelong learning.								√
Social competences								
11. are able to communicate with colleagues working in the field as well as with the broader public, about chemistry-related contents and problems, also in a foreign language and on an intercultural basis,		√						
12. are aware of social and ethical responsibility in their actions and are familiar with the professional ethical principles and standards of chemistry,				√				
13. are able to work both alone and as a member of international, mixed-gender groups,							√	
14. are familiar with the basic principles for conduction of projects and able to develop				√				

Based on Tables 2, 3, and 4 the qualifications obtained by graduates allow them to work in the fields they have planned, according to the graduate profile.

#### Conversion Factor between Indonesian Credit Unit (*sks*) and ECTS

According to the Regulation from the Ministry of Education and Culture of the Republic of Indonesia on National Education Standards. 1 Credit Unit or 1 *sks* equal to the 170 minutes. *One semester consists of 14 weeks of lecturing activities and two weeks for mid-semester test and final semester test.* Total hours (workload) for 1 Credit Unit or *sks* equal to 14 weeks × 170 minutes = 2,380 minutes or 39.67 hours. In Unesa, based on the Rector's Decree 1 ECTS equal to 25 hours (The Decree of Rector Unesa No. 598/UN38/HK/AK/2019 dated June 6th, 2020). So, conversion factor from 1 Credit Unit (CU) or 1 *sks* = 1.59 ECTS.



## Chapter II. Study Plan Description

The minimum workload of Undergraduate Program at Unesa is 144 credit units (CU) which correspond to 6,048 hours or 201.6 ECTS, and are generally distributed in 8 regular semesters. On average, the total hour per year is 756 hours. The normal workload for each regular semester is limited to 840 hours, corresponds to 20 CU (28 ECTS). The normal workload for each short semester is limited to 420 hours, corresponds to 10 credit unit (14 ECTS).

Table 5. Compulsory and elective courses in UPCE

CU Compulsory courses	CU	ECTS	Note
CU of compulsory courses	133	211.47	The CU courses are distributed into 49 compulsory courses.
CU of elective courses	11	17.49	There are 40 available credit unit which is distributed into 19 elective courses and students should take at least 11 course unit.
Total	144	228.96	

The minimum workload of Undergraduate Program at Unesa, especially in the UPCE is 144 Credit Units (CU) which correspond to 5,712.48 hours or 228.96 ECTS, and are generally distributed in 8 regular semesters. On average, the total hour per semester is 714.06 hours. According to the Higher Education National Standards, the maximum workload for each regular semester is limited to 952.08 hours, corresponds to 24 CU or 24 *sk*s (38.16 ECTS).

### The UPCE Curriculum Structure

Based on the results of discussions from the ASIIN taskforce team, analysis of relevant curriculum documents and stakeholders, it is mapped as presented in Table 7. Table 7 presents the linkages between courses and PLO and the number of credits that must be taken by chemistry education students, namely 144 credits.

Table 7. Mapping MK vs PLO

No	Code	Course Title	CU	ECTS	PLO							
					1	2	3	4	5	6	7	8
1	8420402008	Digital Literacy	2	3.18					√			
2	1000002003	Indonesian	2	3.18						√		
3	8420403015	English	3	4.77						√		√
4	8420403039	General Biology	3	4.77						√		
5	8420403069	General Physics	3	4.77						√		
6	8420403123	Basic Chemistry 1	3	4.77	√		√					
7	8420403181	Basic Mathematics	3	4.77						√		
8	1000002018	Pancasila	2	3.18					√			
9	8420402018	English for Chemistry	2	3.18						√		

No	Code	Course Title	CU	ECTS	PLO								
					1	2	3	4	5	6	7	8	
10	8420402094	Qualitative Analytical Chemistry	2	3.18	√		√						
11	8420403122	Basic Chemistry 2	3	4.77	√		√						
12	8420403141	Quantum Chemistry	3	4.77	√								√
13	8420402173	Conservation of Natural Resources and Environment	2	3.18						√			
14	8420403185	Mathematics for Chemistry	3	4.77	√								
15	1000002026	Religion	2	3.18					√				
16	1000002033	Citizenship Education	2	3.18					√				
17	8420402063	Philosophy of Science	2	3.18					√	√			√
18	1000002011	Cultural Social Science Sciences	2	3.18					√				
19	8420402090	Literature of Chemistry	2	3.18						√			
20	8420403098	Quantitative Analytical Chemistry	3	4.77	√		√		√				
21	8420403207	Laboratory Organization	3	4.77			√			√	√		
22	8420403164	Monofunction Organic Compound	3	4.77	√				√				
23	8420403119	Basic Theory of Inorganic Chemistry	3	4.77	√								
24	8420403140	Thermodynamics of Chemistry	3	4.77	√				√				√
25	8420403101	Basics of Chemical Separations	3	4.77	√				√				
26	8420402149	Nuclear Chemistry and Radiochemistry	2	3.18	√								
27	8420402116	Coordination Chemistry	2	3.18	√								
28	8420403135	Chemical Kinetics	3	4.77	√				√	√			√
29	8420403162	Polyfunction Organic Compound	3	4.77	√					√			
30	8420403261	Basic Statistics	3	4.77						√			√
31	8420402105	Electrochemistry Analysis	2	3,18	√				√				
32	8420402190	Spectroscopy and Chromatography Method	3	4,77	√					√			
33	8420402275	Entrepreneurship	2	3.18							√	√	
33	8420403168	Surface Chemistry	3	4.77						√	√	√	
34	8420402114	Main Elements of Inorganic Chemistry	2	3.18	√								

No	Code	Course Title	CU	ECTS	PLO							
					1	2	3	4	5	6	7	8
35	8420403192	Research Methodology	3	4.77					√	√		
36	8420402037	Structure and Function of Biomolecule	2	3.18	√				√		√	
37	8420402128	Pharmaceutical Chemistry	2	3.18	√							
38	8420402147	Industrial Chemistry	2	3.18						√	√	
39	8420403120	Transition Elements of Inorganic Chemistry	3	4.77	√							
40	8420403277	Community Service	3	4.77							√	√
41	8420403034	Metabolism and Pathways of Genetics Information	3	4.77	√				√		√	
42	8420402256	Seminar	2	3.18					√	√	√	
43	8420402167	Food Chemistry	2	3.18	√				√		√	
44	8420402221	Career Development	2	3.18						√		√
45	8420403154	Environmental Chemistry	3	4.77	√				√	√		
46	8420406259	Thesis	6	9.52	√		√			√		√
47	8420402001	Food Analysis	2	3.18	√				√	√		
48	8420402152	Cosmetics	2	3.18							√	
49	1000003006	Basic of Education	3	4.77		√						
50	1000002039	Educational Psychology	2	3.18		√						
51	8420403271	Learning Theories	3	4.77		√						
52	8420403012	Assessment	3	4.77		√						
53	8420403270	School Curriculum Analysis	3	4.77		√						
54	8420403187	Learning Media	3	4.77		√	√					
55	8420403211	Innovative Learning I	3	4.77		√	√	√				√
56	8420403212	Innovative Learning II	3	4.77		√	√	√			√	√
57	8420402188	Chemistry Game Media	2	3.18		√	√		√			
58	8420402224	Creative Learning Media Development	2	3.18		√		√	√			
59	8420402223	ICT Learning Media Development	2	3.18		√	√	√	√			
60	8420402171	School Chemistry	2	3.18		√		√				
61	8420403226	Microteaching	2	3.18		√		√				√
62	8420402180	School Management	2	3.18		√	√					
63	8420402215	ICT-based Learning Chemistry	2	3.18		√	√	√	√			
64	8420402216	Chemistry Learning for Vocational School	2	3.18		√	√					
65	8420403249	Teaching Internshio	4	6.36		√	√	√				√

No	Code	Course Title	CU	ECTS	PLO								
					1	2	3	4	5	6	7	8	
66	8420402011	Development of Assessment Instrument	2	3.18		√		√					
67	8420402282	Physical Education	2	3.18									√

The detailed courses structure of UPCE is shown in the Table 8.

**Table 8.** UPCE's Courses Structure for Each Semester

1st Semester					2nd Semester				
	Code	Course Name	CU	ECTS		Code	Course Name	CU	ECTS
1	1000002018	Pancasila	2	3.18	1	1000002033	Citizenship Education	2	3.18
2	1000002026	Religion Education	2	3.18	2	8420402008	Digital Literacy	2	3.18
3	1000003006	Basic of Education	3	4.77	3	1000002039	Educational Psychology	2	3.18
4	8420403015	English	3	4.77	4	8420402018	English for Chemistry	2	3.18
5	8420403039	General Biology*	3	4.77	5	8420402094	Qualitative Analytical Chemistry*	2	3.18
6	8420403069	General Physics*	3	4.77	6	8420402173	Conservation of Natural Resources and Environment	2	3.18
7	8420403123	Basic Chemistry 1*	3	4.77	7	8420403122	Basic Chemistry 2*	3	4.77
8	8420403181	Basic Mathematics	3	4.77	8	8420403185	Mathematics for Chemistry	3	4.77
					9	8420403271	Learning Theories	3	4.77
TOTAL			22	34.98	TOTAL			21	33.39

\*) integrated with practicum

3rd Semester					4th Semester				
	Code	Course Name	CU	ECTS		Code	Course Name	CU	ECTS
1	1000002011	Basic Social and Cultural Sciences	2	3.18	1	8420403207	Laboratory Organization*	3	4.77
2	1000002003	Indonesian	2	3.18	2	8420403101	Basics of Chemical Separations*	3	4.77
3	8420403098	Quantitative Analytical Chemistry*	3	4.77	3	8420403119	Basic Theory of Inorganic Chemistry	3	4.77
4	8420403141	Quantum Chemistry	3	4.77	4	8420403140	Thermodynamics of Chemistry*	3	4.77
5	8420403164	Mono-function	3	4.77	5	8420403162	Poly-function	3	4.77

3 <sup>rd</sup> Semester					4 <sup>th</sup> Semester				
	Code	Course Name	CU	ECTS		Code	Course Name	CU	ECTS
		Organic Compound					Organic Compound*		
6	8420402282	Physical Education	2	3.18	6	8420403187	Learning Media	3	4.77
7	8420403012	Assessment	3	4.77	7	8420403211	Innovative Learning I	3	4.77
8	8420403270	School Curriculum Analysis	3	4.77					
TOTAL			21	33.39	TOTAL			21	33.39

\*) integrated with practicum

5 <sup>th</sup> Semester					6 <sup>th</sup> Semester				
	Code	Course Name	CU	ECTS		Code	Course Name	CU	ECTS
1	8420402037	Structure and Function of Biomolecule*	2	3.18	1	8420403034	Metabolism and Pathways of Genetics Information	3	4.77
2	8420402116	Coordination Chemistry	2	3.18	2	8420402114	Main Elements of Inorganic Chemistry*	2	3.18
3	8420402190	Spectroscopy and Chromatography Method*	3	4.77	3	8420402256	Seminar	2	3.18
4	8420402275	Entrepreneurship	2	3.18	4	8420402171	School Chemistry	2	3.18
5	8420403135	Chemical Kinetics*	3	4.77	5	8420403226	Microteaching	2	3.18
6	8420403192	Research Methodology	3	4.77	6	Elective Course		7	11.13
7	8420403212	Innovative Learning II	3	4.77					
8	8420403261	Basic Statistics	3	4.77					
TOTAL			21	33.39	TOTAL			18	28.62

\*) integrated with practicum

7 <sup>th</sup> Semester					8 <sup>th</sup> Semester				
	Code	Course Name	CU	ECTS		Code	Course Name	CU	ECTS
1	8420403120	Transition	3	4.77	1	8420406259	Thesis	6	9.54

7 <sup>th</sup> Semester					8 <sup>th</sup> Semester				
	Code	Course Name	CU	ECTS		Code	Course Name	CU	ECTS
		Elements of Inorganic Chemistry*							
2	8420403277	Community Service	3	4.77	2	Elective Course		2	3.18
3	8420403249	Teaching Internship	4	6.36					
4	Elective Course		2	3.18					
TOTAL			12	19.08	TOTAL			8	12.72

\*) integrated with practicum

Table 9 UPCE's Elective Courses

Elective Course Odd Semester						Elective Course Even Semester					
No	Code	Course Name	CU	ECTS	Sem	No	Code	Course Name	CU	ECTS	Sem
1	8420402188	Chemistry Game Media	2	3.18	7	1	8420402090	Literature of Chemistry	2	3.18	6
2	8420402223	ICT Learning Media Development	2	3.18	7	2	8420402215	ICT-based Learning Chemistry	2	3.18	6
3	8420402224	Creative Learning Media Development	2	3.18	7	3	8420402216	Chemistry Learning for Vocational School	2	3.18	6
4	8420402063	Philosophy of Science	2	3.18	7	4	8420402180	School Management	2	3.18	6
5	8420402011	Development of Assessment Instrument	2	3.18	7	5	8420403168	Surface Chemistry	3	4.77	6
6	8420402167	Food Chemistry	2	3.18	7	6	8420403154	Environmental Chemistry	3	4.77	6
7	8420402152	Cosmetics	2	3.18	7	7	8420402221	Career Development	2	3.18	8
8	8420402001	Food Analysis	2	3.18	7	8	8420402128	Pharmaceutical Chemistry	2	3.18	8
						9	8420402147	Industrial Chemistry	2	3.18	8
						10	8420402149	Nuclear Chemistry and Radiochemist	2	3.18	8

Elective Course Odd Semester						Elective Course Even Semester					
No	Code	Course Name	CU	ECTS	Sem	No	Code	Course Name	CU	ECTS	Sem
								ry			
						1 1	8420402105	Electrochemis try Analysis	2	3.18	8

In the common first year, students are obliged to attend courses to provide a good foundation of natural science and basic education to acquire scientific thought towards the planning, development and evaluation of chemistry learning.

For more information about the courses each semester (compulsory and elective), please visit the webpage: <https://pendidikan-kimia.fmipa.unesa.ac.id/page/module-handbook>