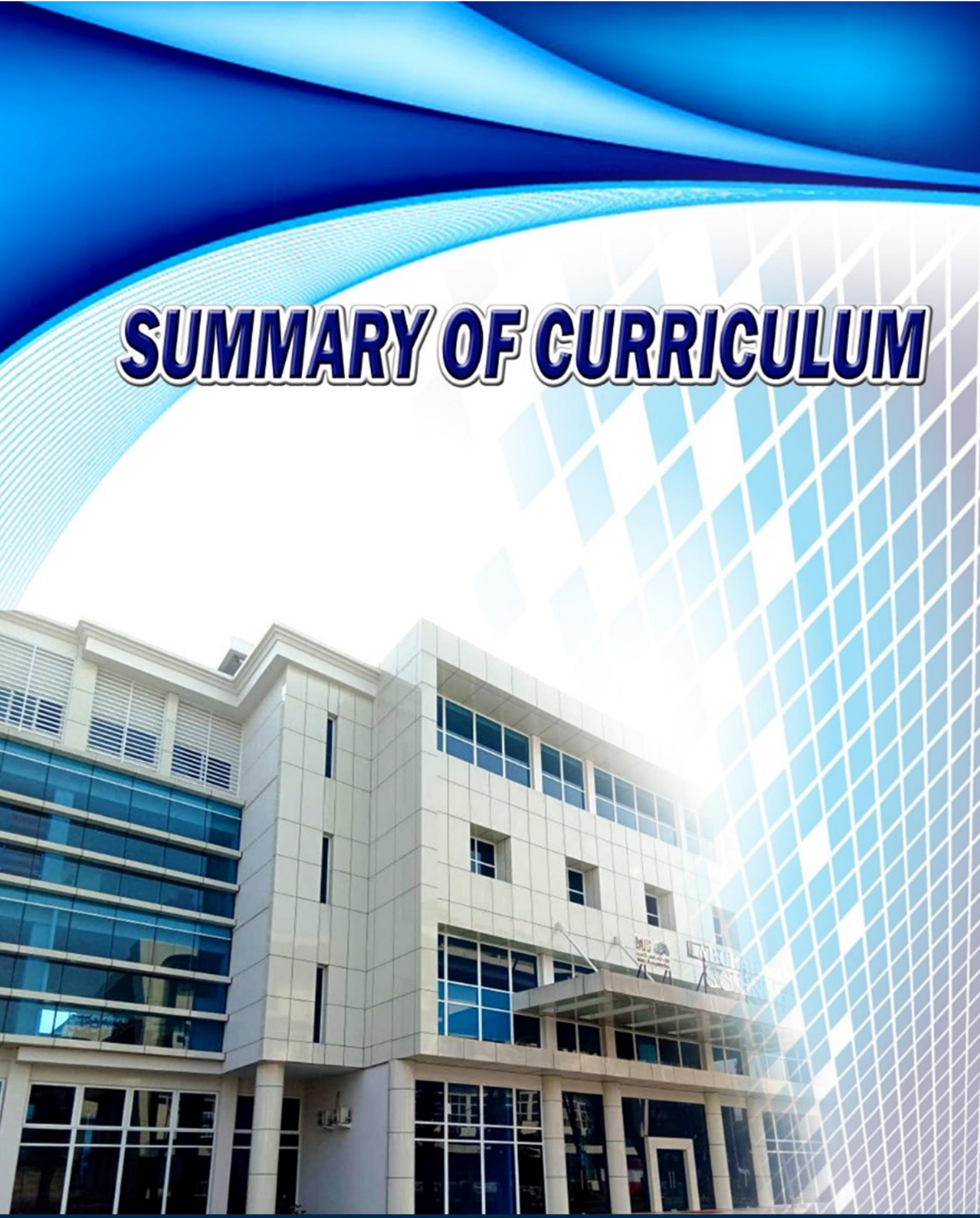
SUMMARY OF CURRICULUM



UNDERGRADUATE PROGRAMME IN SCIENCE EDUCATION
FACULTY OF MATHEMATICS AND NATURAL SCIENCES
UNIVERSITAS NEGERI SURABABAYA
2020

OBJECTIVE OF THE DEGREE PROGRAM

The Undergraduate Program of Science Education (UPSE) belongs to Department of Natural Science at Faculty of Mathematics and Natural Sciences (FMNS) in Universitas Negeri Surabaya (UNESA). This study program was established on 21 December 2006 based on the Decree of General Director of Higher Education of the National Education Department of Indonesia No. 4905/D/T/2006. Objectives of this study program were derived from the visions and missions of institution and faculty as detailed in the following paragraphs.

1. The Vision and Mission of Institution

Vision of Universitas Negeri Surabaya:

Excellent in Education, Strong in Science

Mission of Universitas Negeri Surabaya:

(1) To organize education and learning centered on students by using effective learning approaches and technology
(2) To conduct 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) To disseminate science, technology, arts, culture and sports, and research results through community service oriented towards empowering and accustoming society
(4) To embody Universitas Negeri Surabaya as a center of education not only for primary and secondary education but also for scientific centers based on the noble values of national culture
(5) To organize autonomous, accountable, and transparent governance for quality assurance and quality improvement.

2. The Vision and Mission of Faculty

Vision of Faculty of Mathematics and Natural Science (FMNS):

Excellent in Educational Mathematics and Natural Science, Strong in Mathematics and Natural Science Studies

Extended Vision of Faculty of Mathematics and Natural Science (FMNS):

(1) Excellence in mathematics and natural science education innovation.
(2) Strength not only in mathematics and natural sciences studies and its application but also be able to reinforce mathematics and natural science education (wider mandate).
(3) Excellence in global competition.
(4) Excellence graduates who are environmentally minded and have an entrepreneurial spirit.

The term "excellent" referred to the FMNS Vision means to be innovative, competitive, and always trying to improve quality. The term "strong" means to work systematically, methodically, and objectively, in order to support the excellence of the studies in mathematics and natural sciences.

Mission of FMNS

(1) To organize innovative and research-based mathematics and natural sciences education in order to produce graduates who have environmental insight, an entrepreneurial spirit and global competitiveness.

(2) To conduct mathematics and natural sciences research in strengthening science that is recognized nationally and internationally as well as strengthening mathematics and natural science education.
(3) To organize research-based community service for supporting the community welfare.
(4) To build a strong network with stakeholders for improving the quality and image of FMNS.
(5) To organize autonomous, credible, fair, accountable, and transparent governance for quality assurance and quality improvement in FMNS.

Objectives of FMNS

a) To produce graduates of MNS and MNS education who have environmental insight, entrepreneurial spirit, and global competitiveness.
b) To produce MNS research and MNS education products to strengthen MNS and MNS education.
c) To implement the result of the research for community service in order to support community welfare.
d) To build strong collaboration with stakeholders for improving the quality and image of FMNS.
e) To build a system in FMNS that is autonomous, credible, fair, accountable, and transparent for quality assurance and quality improvement.

3. Program Educational Objectives (PEO)

As a consequence of the vision and mission of UNESA and FMNS in accordance to a Rector Decree no. 466/UN38/HK/DT/2016 about Curriculum development based on the Indonesian National Qualification Framework (KKNI) for study program, the Program Educational Objectives (PEOs) of UPSE focus on producing graduates who are capable of becoming science educators particularly at middle school level, researchers of science education, and entrepreneurs in the fields of applied science or science education. In detail, the PEOs of UPSE are as follows:

1. Mastering knowledge / skills in the field of pedagogical integrated science (physics, chemistry, and biology) to carry out their professional or entrepreneurial tasks (PEO 1);
2. Having responsibility in carrying out his professional duties based on professional ethics (PEO 2);
3. Having a strong and tough personality and be able to compete globally in carrying out the tasks of his profession or entrepreneurship (PEO 3);
4. Having capability to communicate and work together in carrying out professional tasks (PEO 4);
5. Having capability to do self-development and innovations sustainably based on the situation and challenges in their professional duties (PEO 5).

The PEOs were formulated by considering the input from alumni and science education experts, curriculum for middle school students, evaluation results of tracer studies, and National Science Education Standards (NSES) 1996. These PEOs also have significant relevancies with the Indonesian National Qualification Framework (KKNI). Table 1 indicates the relationship between PEO(s) of UPSE and the 6^{th} level (the level for bachelor education) of the National

Qualification Framework. Through these PEOs, the graduates of UPSE are expected to have capability to compete locally and globally.

Table 1. The Relationship between PEOs of UPSE and the Indonesian National Qualification Framework

	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
PEO 1	S	S	S	M
PEO 2	S	S	S	S
PEO 3	S	S	S	S
PEO 4	M	S	M	S
PEO 5	S	S	S	S

S-Strong, M-Moderate

4. Program Learning Outcomes (PLO)

Derived from the PEOs, the UPSE proposed Program Learning Outcomes (PLOs) as shown in Table 2.

Table 2. PLO of UPSE

Competency SSC-ASIIN	Aspect	PLO	DESCRIPTION
Specialist competences	**Knowledge**	PLO 1	Demonstrate basic knowledge of physics, chemistry, and biology.
		PLO 2	Demonstrate knowledge of integrated science (physics, chemistry, and biology).
		PLO 3	Demonstrate pedagogical knowledge of designing, implementing, and evaluating integrated science learning.
		PLO 4	Demonstrate knowledge related to science education research.
	Special Skills	PLO 5	Design, implement, and evaluate science learning using ICT.
		PLO 6	Design and conduct research about learning of integrated science, and acquire, analyze, and interpret the research data.
Social competences	**General Skills**	PLO 7	Communicate ideas and research results effectively both in oral and written forms.
		PLO 8	Make decisions based on data / information in order to complete tasks and evaluate the performance that has been done.
		PLO 9	Work effectively both individually and in groups, and have entrepreneurial spirits and environmental awareness.
	Attitude	PLO 10	Demonstrate scientific, critical, and innovative attitudes in integrated science

Competency SSC-ASIIN	Aspect	PLO	DESCRIPTION
			learning, laboratory activities, and professional-related tasks.
		PLO 11	Demonstrate religious and cultural values as well as academic ethics in carrying out their professional-related duties.

Regard to the aspects of connection between PLO and PEO, Table 3 gives an overview how strong each of PLOs supports the PEO.

Table 3. Correlation between the PEOs and PLOs of UPSE

PLO	PEO				
	PEO-1	PEO-2	PEO-3	PEO-4	PEO-5
PLO 1	S	S	S	M	M
PLO 2	S	S	S	M	M
PLO 3	S	S	S	M	S
PLO 4	M	S	S	M	S
PLO 5	S	S	S	M	S
PLO 6	S	S	S	S	S
PLO 7	S	M	S	S	S
PLO 8	S	S	S	S	S
PLO 9	S	S	S	S	S
PLO 10	S	M	S	S	S
PLO 11	M	M	M	M	S

S-Strong, M-Moderate

PROGRAM STRUCTURE

Similar to the formulation of PEOs, the current curriculum of UPSE was formulated based on the inputs from stakeholders, alumni, and science education experts. In addition, the current national curriculum for middle school (K13 curriculum), National Science Education Standards (NSES) 1996 were also considered to develop the current curriculum of UPSE. Furthermore, Indonesian National Qualification Framework (KKNI) for Bachelor Degree and National Standard for Higher Education in Indonesia (SN DIKTI) were reviewed to identify essential competencies for graduates of UPSE. Those aspects then were used to identify the important content knowledge and skills for educators for middle school students. Using the information, course subjects of UPSE were proposed and organized in curriculum structure. The proses of curriculum development is summarized in Figure 1.

Furthermore, the development of UPSE curriculum was conducted by adopting five principles of UNESA curriculum development. The five principles includes relevancy, flexibility, continuity, efficiency, and effectiveness. UPSE curriculum is relevant to social needs because it was developed based on national standard (e.g., KKNI, SN DIKTI) and international standards (e.g., NSES 1996) and the input from alumni, experts, and stakeholders. In other words, the UPSE curriculum is preparing the graduates to meet users' requirements. UPSE curriculum is also flexible as it is always adjusted to the current national issues in education, such as K13 curriculum. Continuity of UPSE curriculum is illustrated in Figure 3 and Roadmap PLO. Figure 3 shows that one course subject may support one or more other subjects from the same or

different disciplines indicating the relationship among the parts of the curriculum. To improve efficiency and effectiveness of UPSE curriculum, all relevant aspects (see Figure 1) were considered and combined to achieved the proposed PEOs.

The proposed curriculum structure as well as the course syllabus have been revised and applied within the period of 2015 - 2020. Continuous evaluation of the implementation of the UPSE's curriculum is conducted annually.

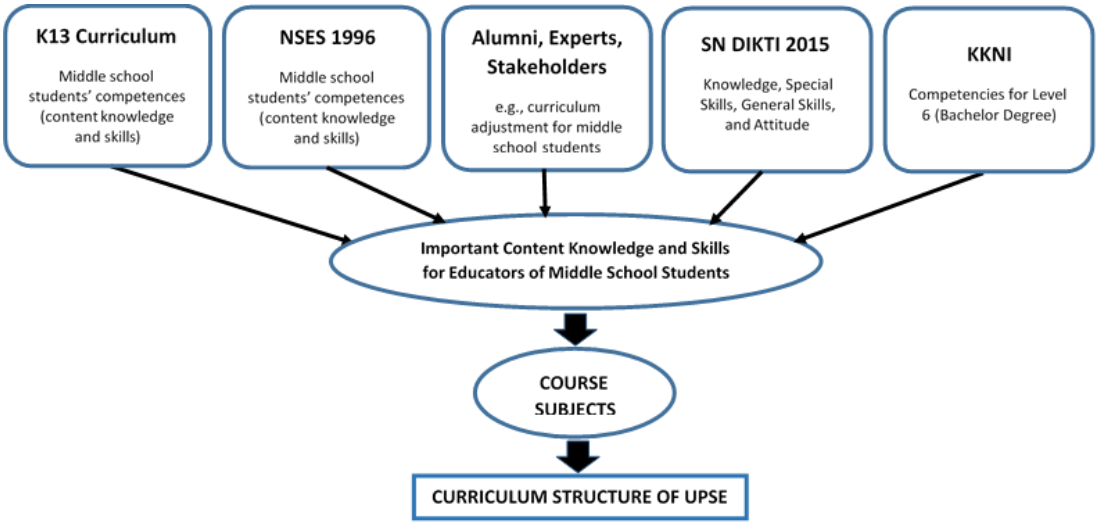


Figure 1. The development process of curriculum structure of UPSE

The curriculum of UPSE is delivered in 4 phases/years through 3 main structures: basic knowledge, interdisciplinary knowledge and pedagogical knowledge, as shown in Figure 2. In this structure, the learning process to gain the main competencies is modelled as a house. Basic and interdisciplinary knowledge are the foundation or the main requirement for students to learn pedagogical knowledge which is represented as the pillars of the house. Both basic and interdisciplinary knowledge function as pedagogical content knowledge. Without the content knowledge, pedagogical knowledge is meaningless. As a student mastery both content and pedagogical knowledge, they are expected to have competencies of science educators or teachers as the roof which cover all science education knowledge.

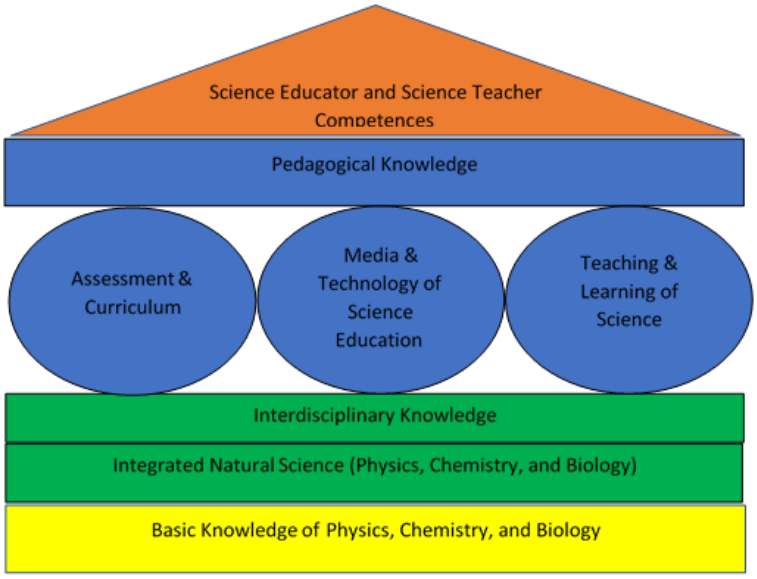


Figure 2. Model of curriculum structure of UPSE

The minimum workload of Undergraduate Program at Unesa is 144 credit units (CU) which correspond to 5,712 hours1* or 228.48 ECTS2*, and are generally distributed in 8 regular semesters. On average, the total hour per semester is 714 hours. The normal workload for each regular semester is limited to 793.33 hours, corresponds to 20 CU (32 ECTS). The detailed curriculum structure of UPSE in relation to PLOs is shown in Table 4.

[1] In Universitas Negeri Surabaya, referring to 2019/2020 academic handbook, 1 CU for bachelor degree equals to 3 workhours per week or 170 minutes (50' face to face learning, 60' structured learning, and 60' independent learning). In one semester, courses are conducted in 14 weeks (excluding mid- and end-term exam). Thus, 1 CU equals to 39.67 workhours per semester.

[2] 1 CU equals to 1,586667 or 1.59 ECTS, assuming that 1 ECTS equals to 28.56 workhours per semester..

Table 4. Mapping of the courses that support PLOs of UPSE

No	Code	Course title	Workload			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
			L	P	C											
																Semester I
1	1000002020	Pancasila Education	2	-	2									√		√
2	8420103012	English	3	-	3							√				
3	8420103045	General Physics	2	1	3	√	√									
4	8420103074	General Chemistry	2	1	3	√	√									
5	8420103023	General Biology	2	1	3	√	√									
6	1000002003	Indonesian Language	2	-	2							√				
7	8420103086	Basic Mathematics	2	1	3	√	√									
8	1000003006	Introductory of Education	2	1	3			√								
																Semester II
9	1000002026	Religion Education	2	-	2											√
10	1000002033	Citizenship Education	2	-	2									√		√
11	8420102183	Digital Literacy	2	-	2					√						
12	8420103088	Mathematic for Science	2	1	3	√	√									
13	1000002039	Educational Psychology	2	-	2			√								
14	8420102028	Introductory of Natural Science	2	-	2	√	√									
15	8420103155	Learning Theory	3	-	-			√								
16	8420102032	Basic Computer	2	-	2				√							
17	8420103065	Biodiversity	2	1	3	√	√									
																Semester III
18	8420102159	History and Philosophy of Science Education	2	-	2				√					√		
19	8420103154	Curriculum Review	3	-	3			√								
20	8420102176	Entrepreneurship	2	-	2											
21	8420102060	Social and Culture Study	2	-	2							√	√			√
22	8420103053	Biomechanics	2	1	3		√									
23	8420103162	Plant Anatomy and Physiology	2	1	3		√									
24	8420103158	Matter and Energy	2	1	3		√									
25	8420103161	Management and Work Safety in the Laboratory	2	1	3								√		√	
																Semester IV
26	8420103107	Innovative Learning I	2	1	3			√		√						
27	8420103167	Animal Anatomy and	2	1	3		√									

No	Code	Course title	Workload			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
			L	P	C											
		Physiology														
28	8420103048	Fluids	2	1	3		√									
29	8420102076	Conservation of Natural Resources and the Environment	2	-	2	√							√			
30	8420103163	Introduction to Biochemistry	2	1	3		√									
31	8420103090	Learning Media	2	1	3			√		√						
32	8420103010	Assessment and Evaluation	3	-	3			√		√						
33	8420101184	Internship I	-	1	-		√		√	√			√		√	
		Semester V														
34	8420103109	Innovative Learning II	2	1	3			√		√						
35	8420103138	SETS	2	1	3		√									
36	8420103033	Ecology	2	1	3		√									
37	8420103081	Solution	2	1	3	√										
38	8420103067	Live at Cellular Level	2	1	3		√									
39	8420103068	Electricity and Magnetism	2	1	3		√									
40	8420103094	Research Method	2	1	3			√		√	√					
		Semester VI														
41		Elective course *)	2	1	3	√										
42	8420103168	Statistics of Education	2	1	3						√					
43	8420102005	Science School Analysis	2	-	2	√	√									
44	8420103049	Waves and Optics	2	1	3		√									
45		Elective course*)	2	1	3		√									
46	8420102142	Seminar	2	-	2			√		√	√				√	√
		Semester VII														
47		Elective course*)	2	1	3		√									
48	8420103178	KKN	3	-	3							√		√		
49		Elective course*)	2	-	2	√										
50		Elective course*)	3	-	3									√		√
51	8420104182	Internship II	4	-	4		√		√	√			√		√	
		Semester VIII														
52	8420106146	Thesis	6	-	6			√		√	√				√	√
53	8420103038	Elective course *)	2	1	3	√										√
54	8420102029	Elective course *)	2	-	2	√										

Notes: L (lecturing), P (laboratory), C (credit unit)

Table 5. Compulsory and elective courses in UPSE

Courses	CU	ECTS	Note
Compulsory	132	209.88	CU courses are distributed into 50 compulsory courses including compulsory UNESA courses.
Elective	16	25.44	There are 16 credits which are divided into 6 elective courses and must take a minimum of 16 subjects.

Table 6. UNESA compulsory courses

No.	Code	Course Name	CU
1	1000002026	Religion Education	2
2	1000002030	Pancasila Education	2
3	1000002018	Digital Literacy	2
4	1000002033	Citizenship Education	2
5	1000002039	Educational Psychology	2
6	1000002003	Indonesia Language	2
Total			12

Table 7. Internal elective courses in UPSE

No.	Code	Course Name	CU
1	8420102029	Introductory of Biotechnology	2
2	8420103038	Ethnoscience	2
3	8420102073	Household Chemistry	2
4	8420103171	Atom and Radioactivity	3
5	8420103064	Review of Science Research Findings	2
6	8420103170	Introductory of Electronic	2
7	8420103123	Earth and Planetary Science	3

The relationship among courses within the curriculum structure of UPSE is illustrated in curriculum roadmap as shown in Figure 3. The roadmap also portrays the paths that undergraduates have to go through to acquire three essential knowledge as shown in Figure 2. Furthermore, the roadmap represents explicitly the integration of science components (physics, chemistry, and biology) within the curriculum of UPSE.

In the first year of study, students who enrolled in UPSE are obliged to attend courses which provide basic knowledge of natural science and education. The courses include Introductory of Natural Science, General Physics, General Chemistry, General Biology, Mathematics of Science, Introductory of Education, Educational Psychology and Learning Theory. Within this year, students learn natural science components (physics, chemistry, and biology) separately. These basic courses give foundations for students to learn advance subjects or interdisciplinary knowledge in the following semesters. In order to support students' development of interpersonal capability, moreover, students need to enroll in other courses, such as Religion Education, Pancasila Education, English, Indonesia Language, Digital Literacy and Basic Computer.

Starting from the third semester, students of UPSE begin to learn interdisciplinary knowledge through courses which integrate two or more natural science components, such as Biomechanics, Fluid, and Introductory of Biochemistry. Other courses, indeed, integrate natural science with other field, such as technology (Introductory of Biotechnology; SETS) and culture (Ethnoscience). While learning some interdisciplinary knowledge, students also learn in depth essential components of pedagogical knowledge through four separate courses including Curriculum Review, Innovative Learning, Learning Media, and Assessment and Evaluation. The students are further encouraged to apply their science and pedagogical knowledge and skills in practice-oriented courses, such as Research Methods, Microteaching, and Seminar. The Research Methods and Seminar are in series courses. The former requires

students to create a research proposal in education, while the latter provides practices for students to communicate their created research proposal. Students' pedagogical knowledge and skills are developed and sharpened through Microteaching course. Moreover, the internship as the practice-based learning is also well-integrated into the program structure to provide students with useful experiences for their future professional life and for sharpening their knowledge and skills. The study program is concluded by taking final project worth 6 CU known as Thesis.

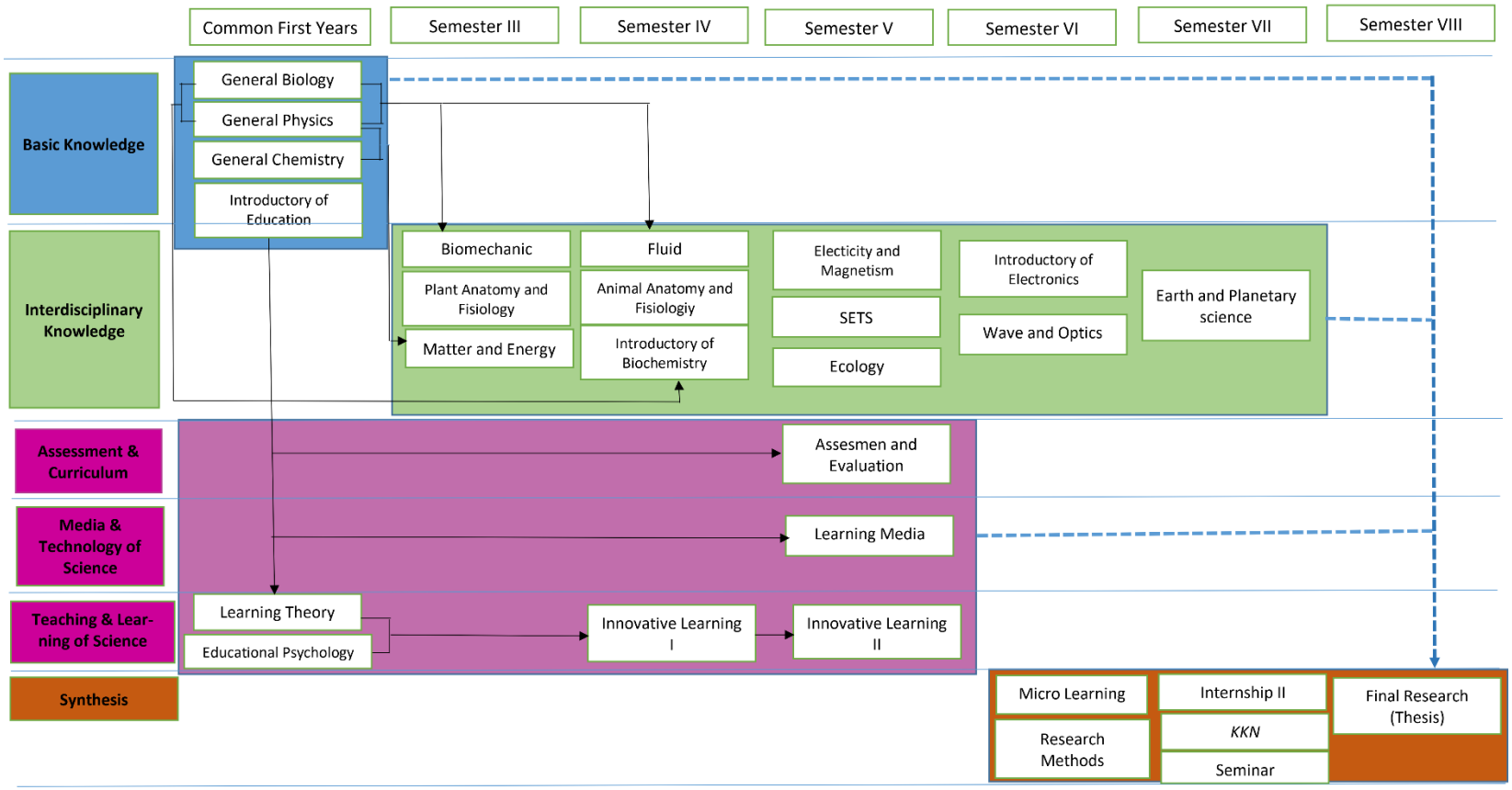
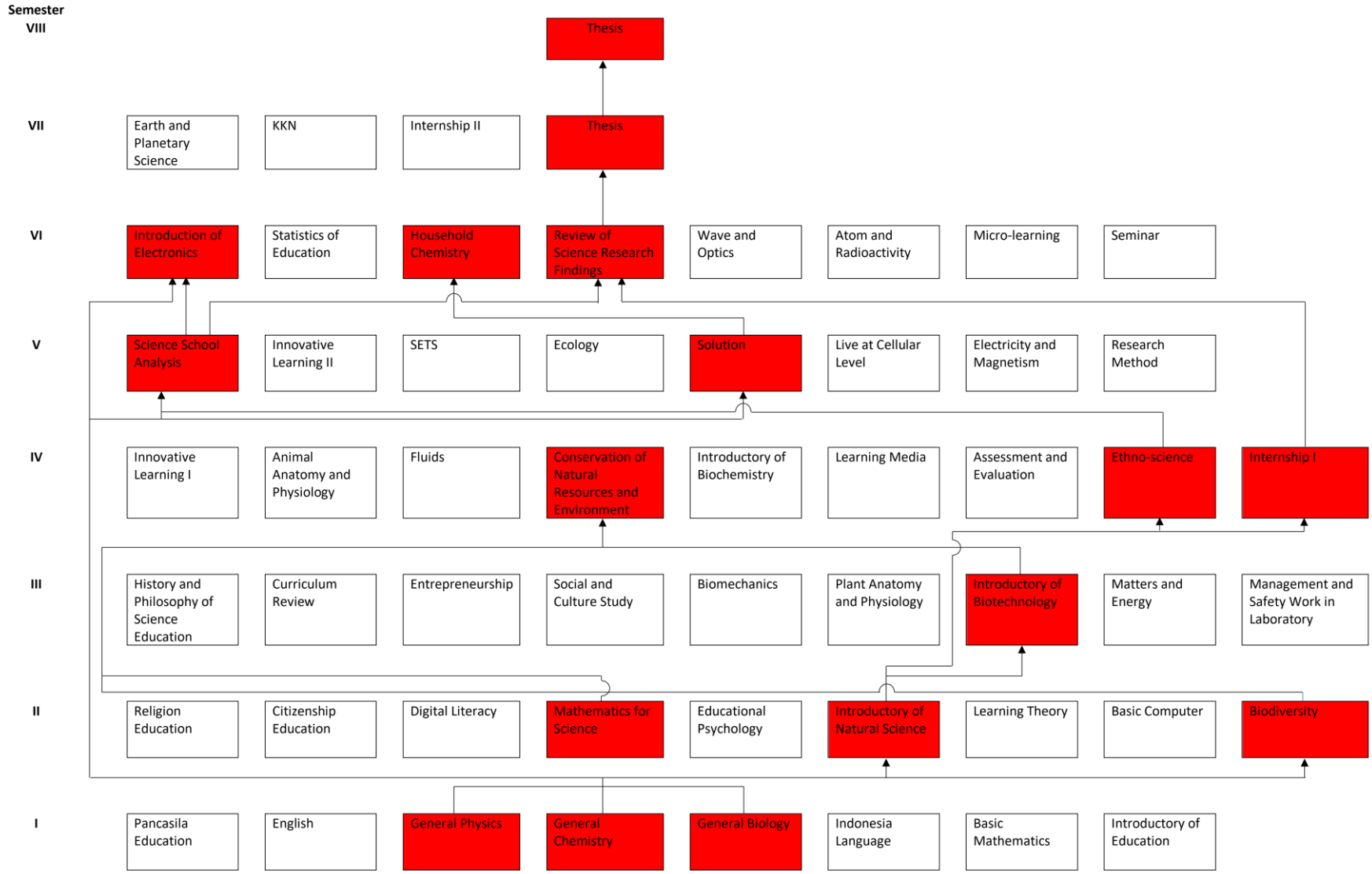
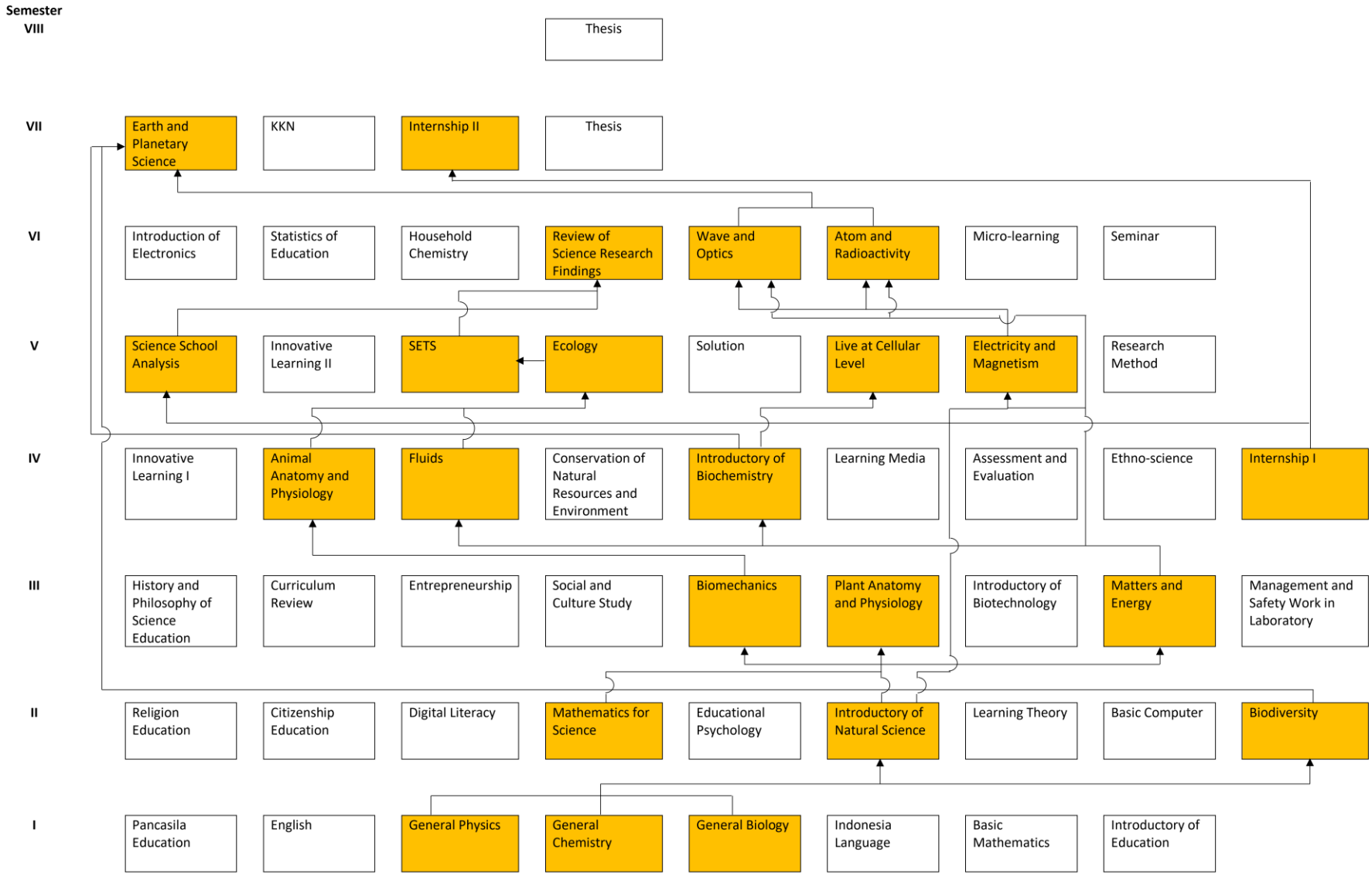


Figure 3. Curriculum Roadmap of UPSE

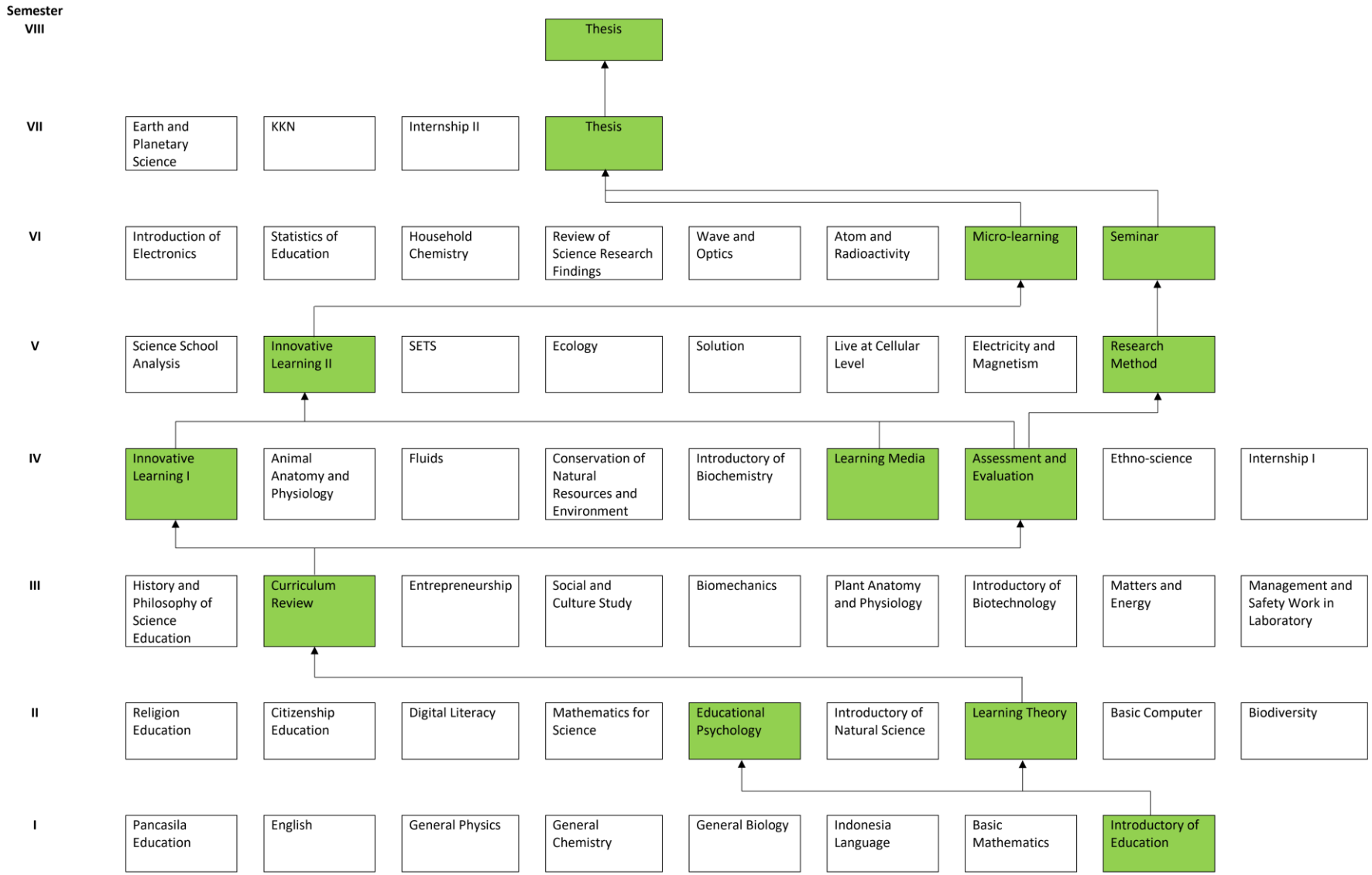
PLO 1 ROADMAP



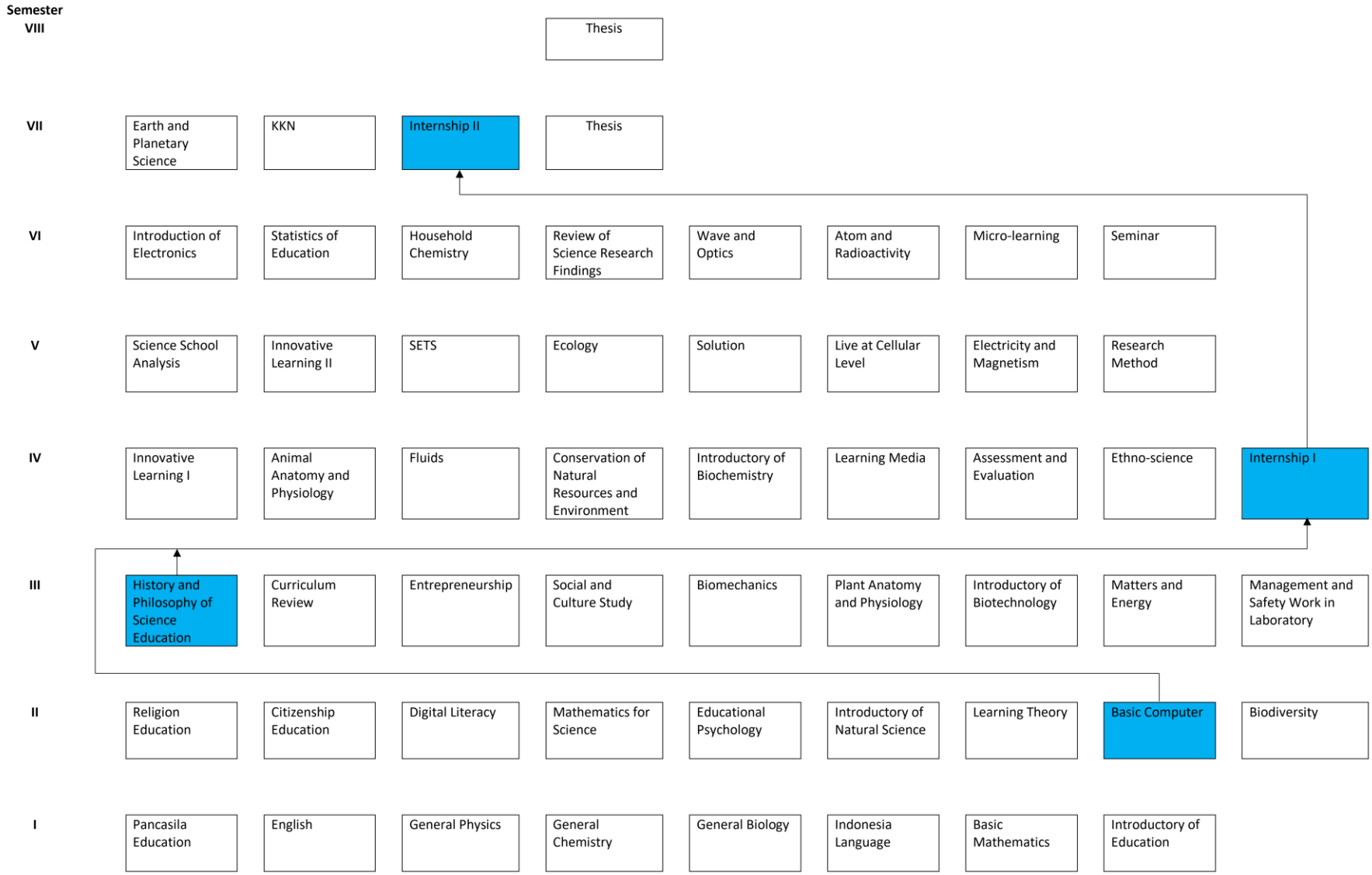
PLO 2 ROADMAP



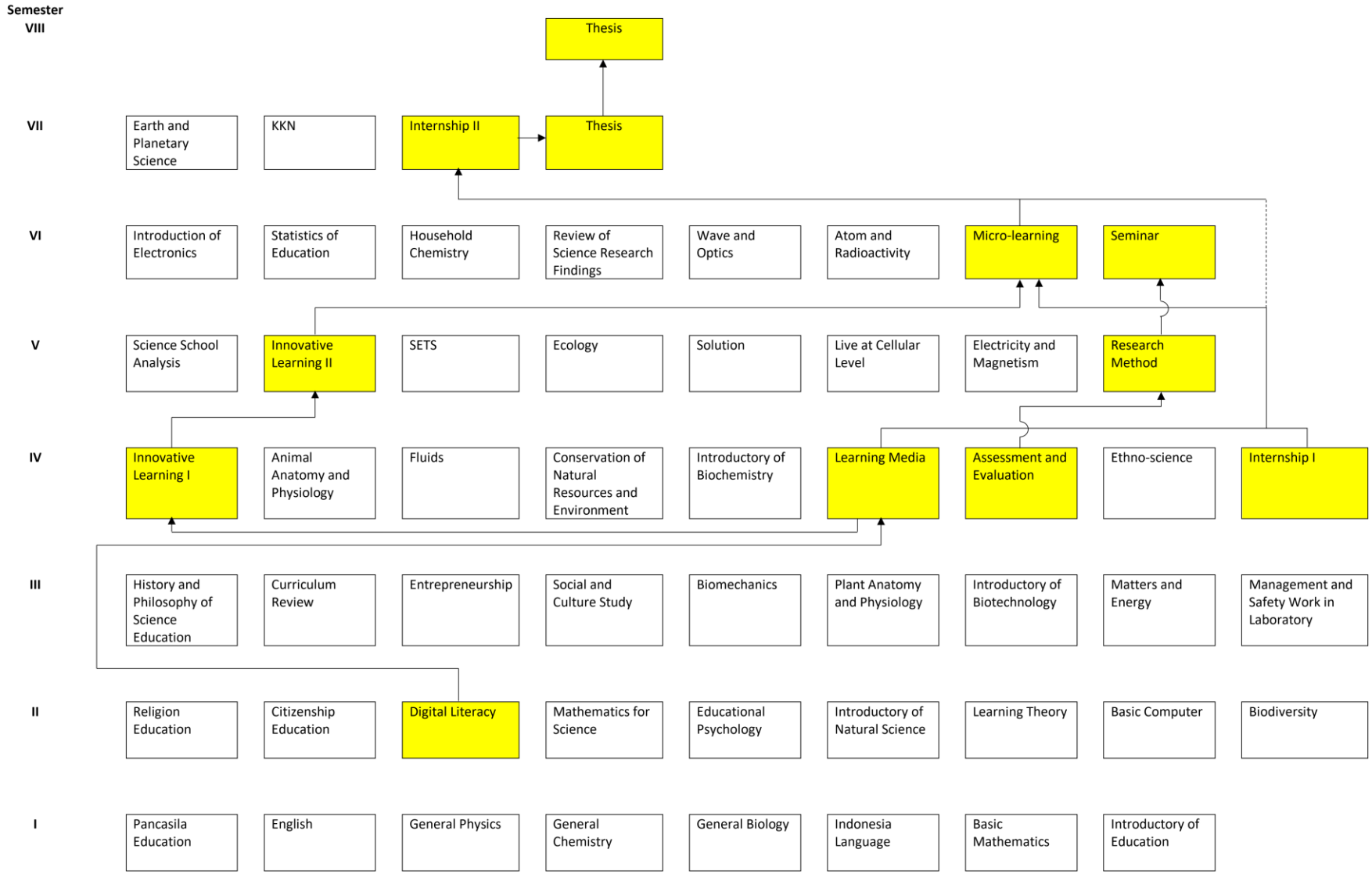
PLO 3 ROADMAP



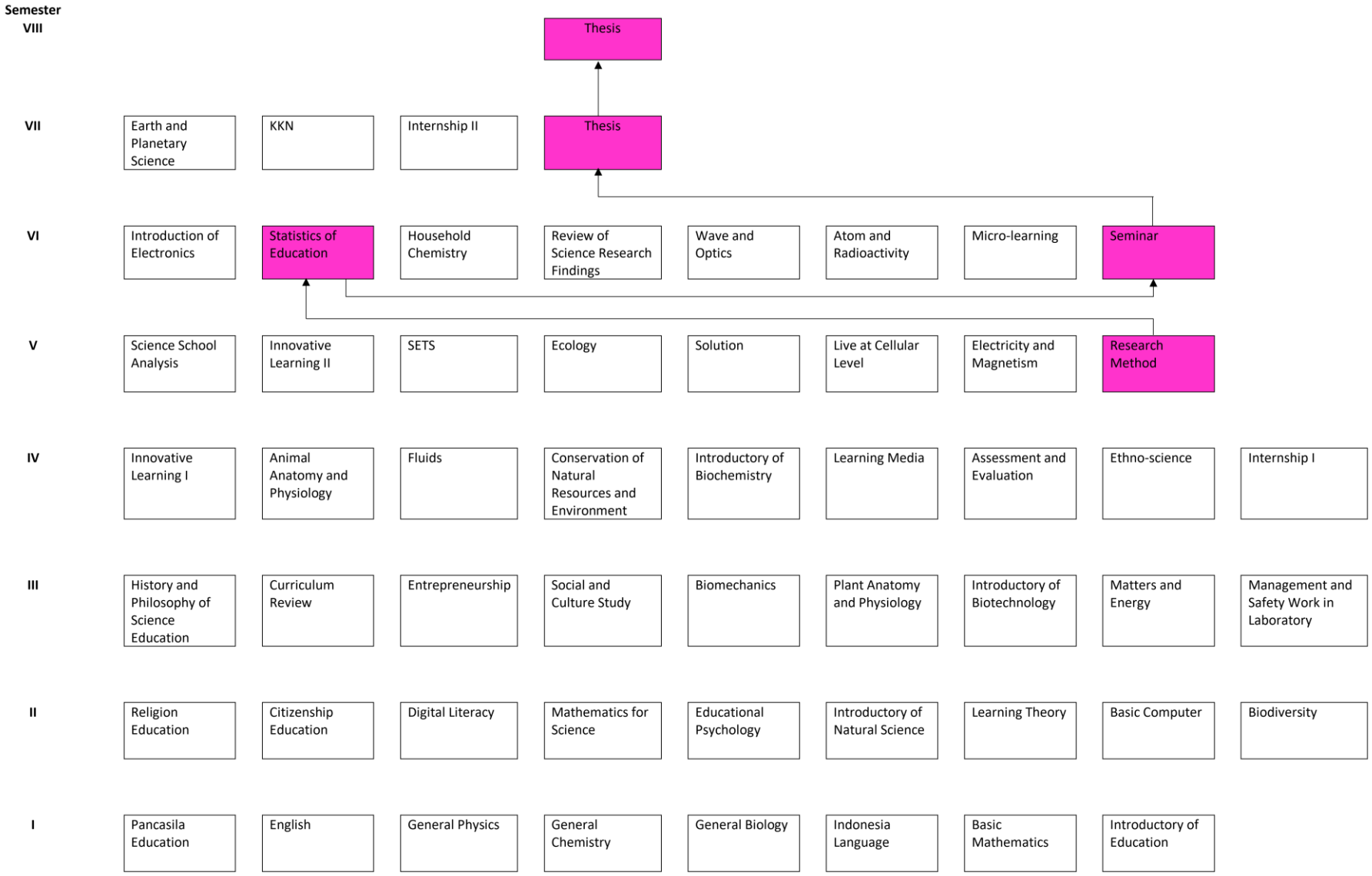
PLO 4 ROADMAP



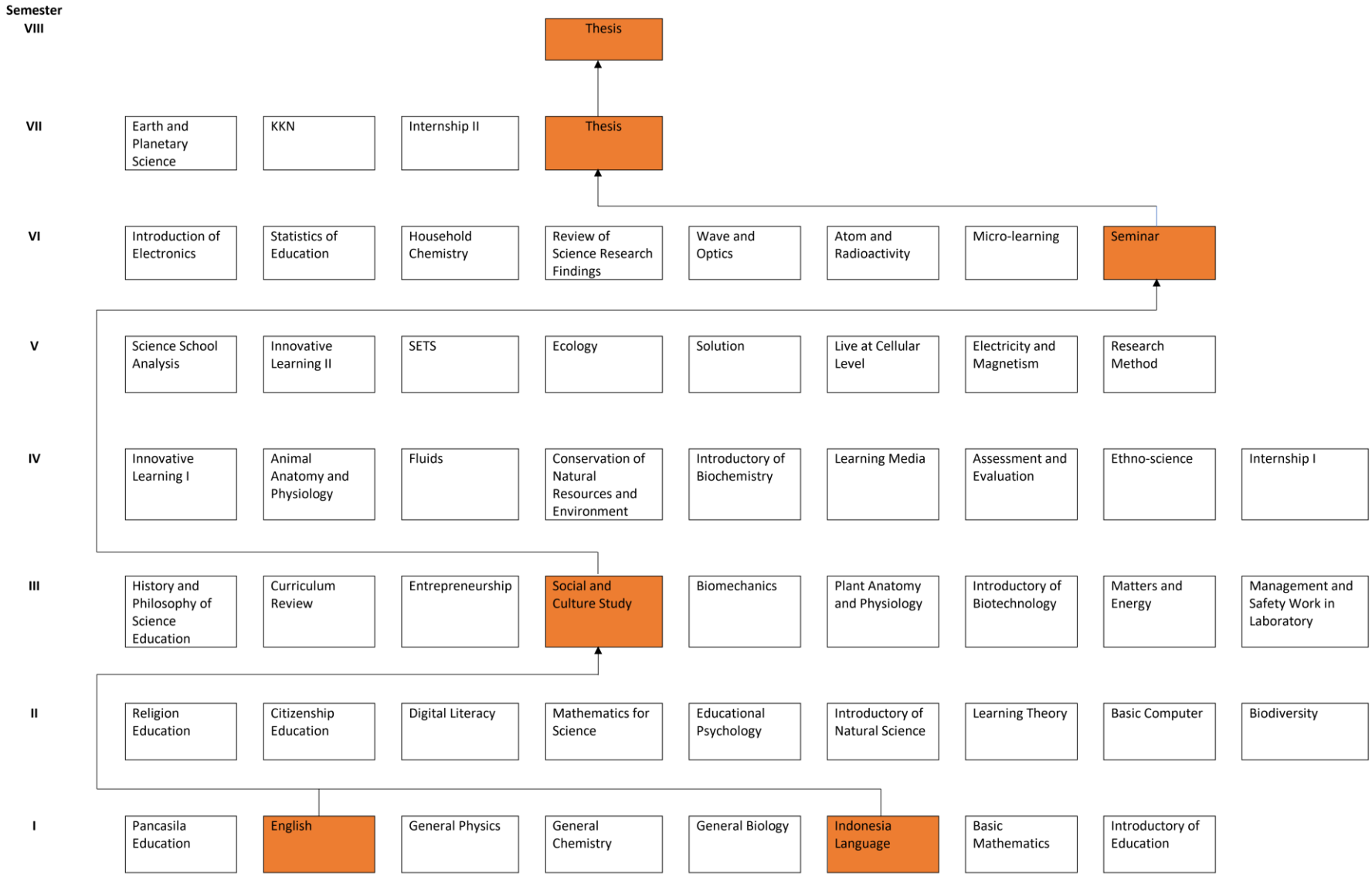
PLO 5 ROADMAP



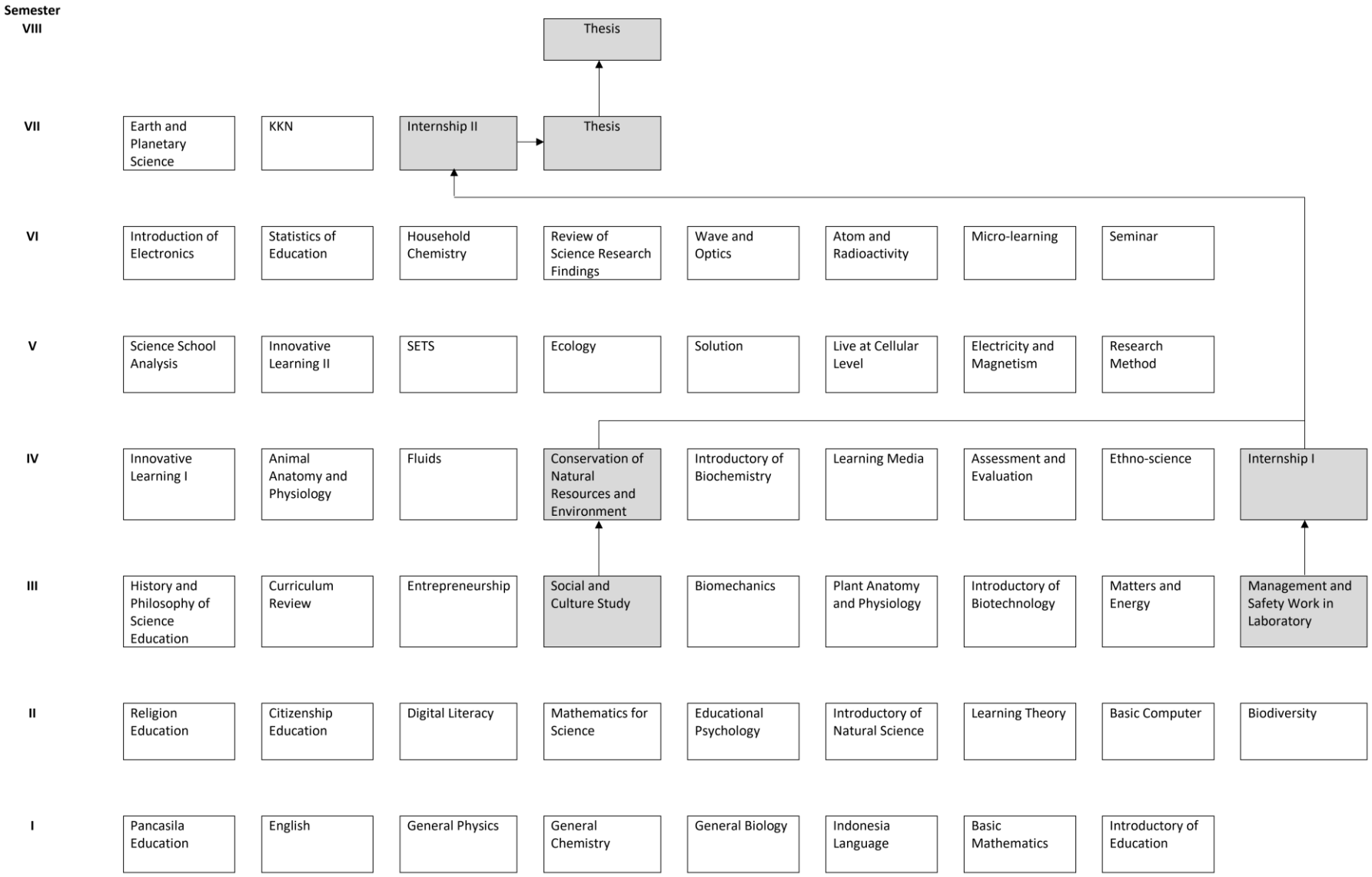
PLO 6 ROADMAP



PLO 7 ROADMAP



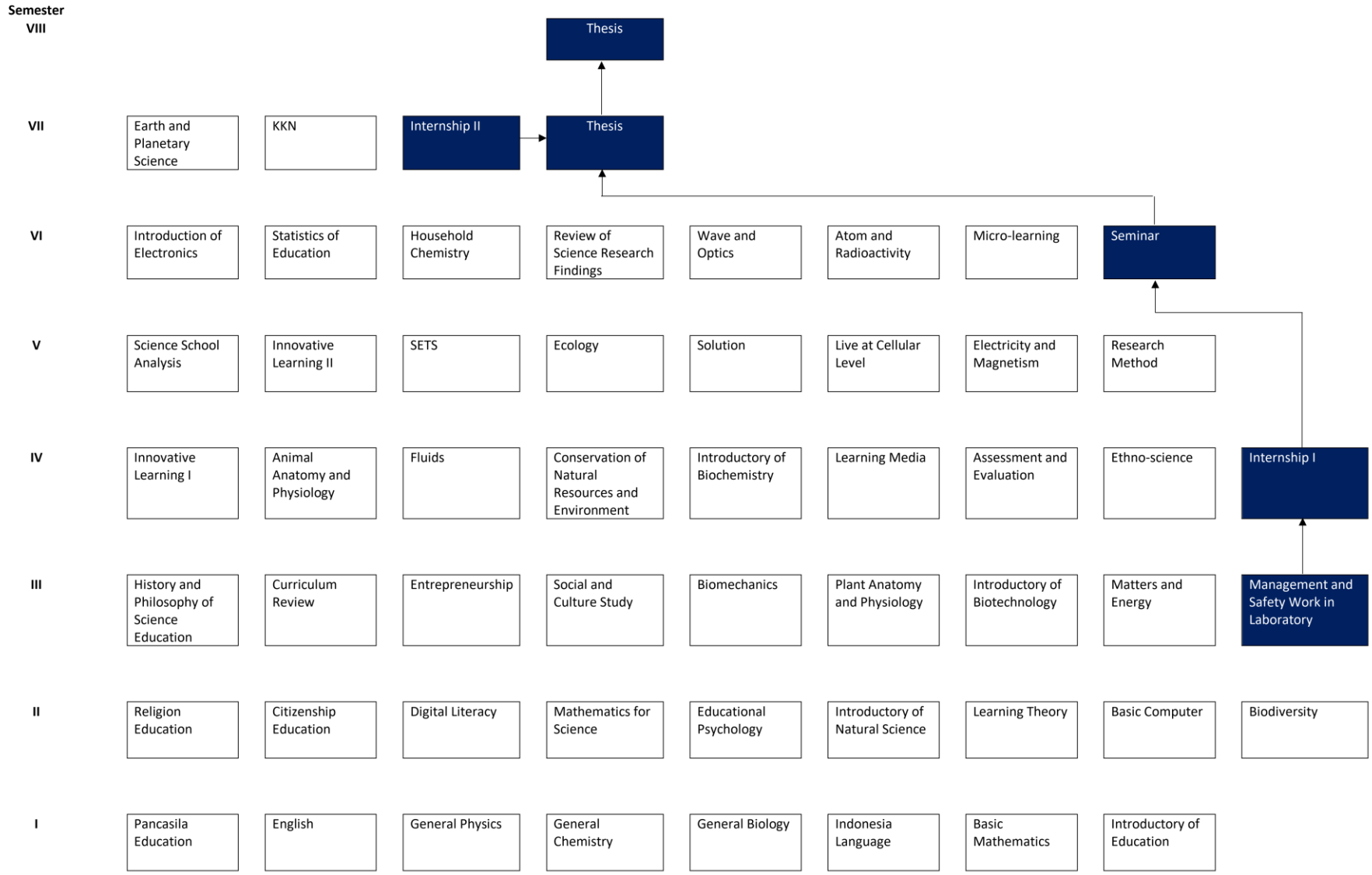
PLO 8 ROADMAP



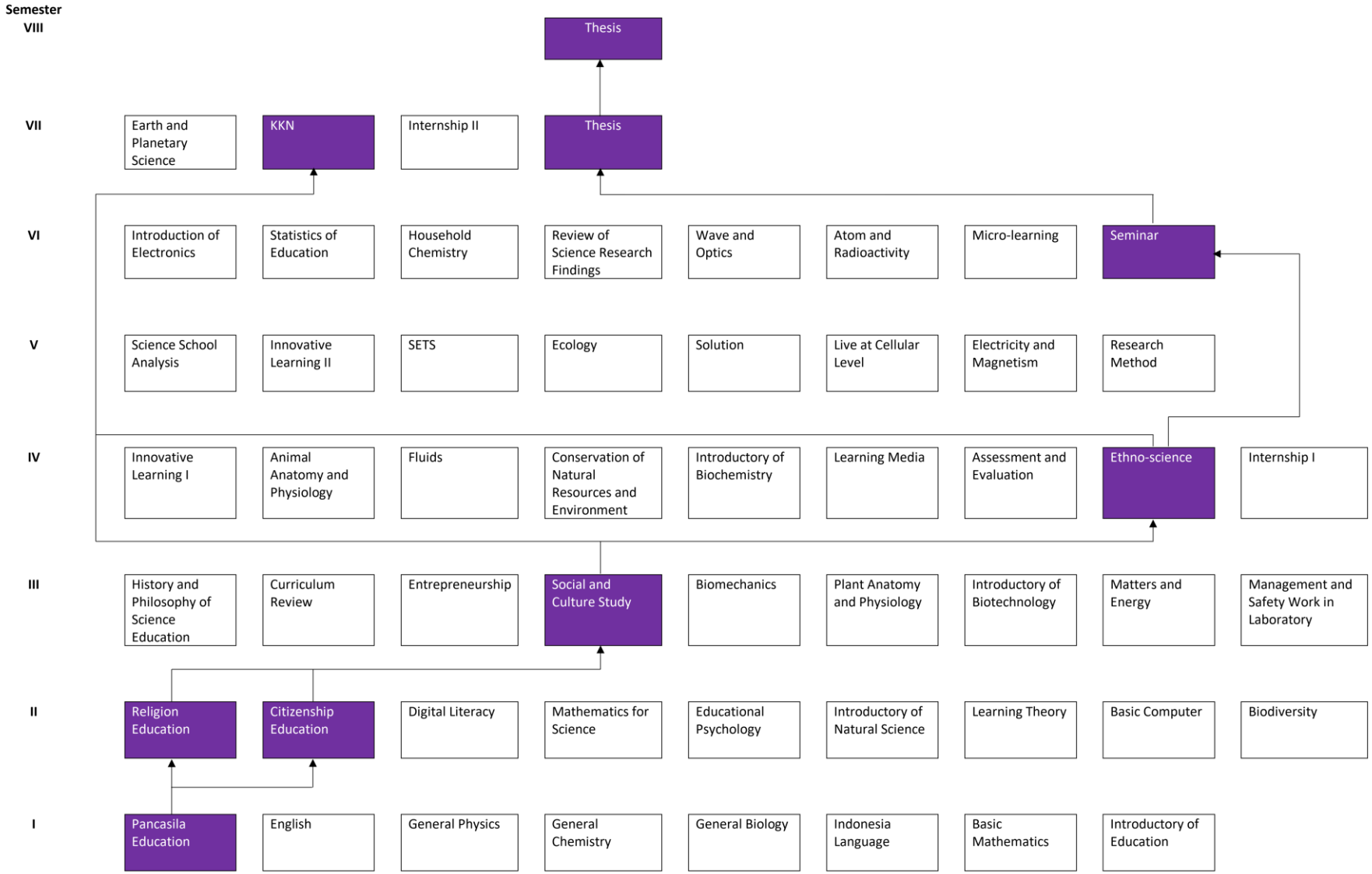
PLO 9 ROADMAP



PLO 10 ROADMAP



PLO 11 ROADMAP



Brief Descriptions of Courses offered by UPSE:

1. Pancasila Education
   This course will discuss the concept and essence of Pancasila as the basis and ideology of the state, as well as the nation's outlook on life. This course also examines Pancasila historically, juridical and philosophically and its actualization in the life of the nation and state. Pancasila as a foundation in Political Ethics and Development Paradigm and its implementation in the life of society, nation and state through studies, presentation of concepts, discussions, case studies, and assignments of both individuals and groups.

2. English
   This course equips students with basic and intermediate English language skills in reading, writing, and listening that support the competence of prospective science teachers. The coverage discussed includes writing-plurals in examples of reading texts, word orders, determiners, modals, tenses, passive voice, subject-verb agreements, gerunds & infinitives, adjective clause & adjectives, reading, vocabulary, writing, listening in theory and presentation. Lectures are carried out with learning strategies with directions, text analysis, discussion, assignments (practicing) individually and in groups, and reflection.

3. General Physics
   This course discusses facts, concepts, principles / laws, and measurement procedures, kinematics, dynamics, temperature, heat, and heat transfer. Lectures are conducted with discussions, laboratory activities (inquiry, experiments, and / or problem solving). Assessment includes observation of attitudes and activeness, assignments, written tests, and performance appraisals.

4. General chemistry
   This course discusses the application of various learning resources, learning media, and appropriate laboratory activities to support the mastery of concepts: Scientific Method, Material Properties, Stoichiometry, Periodic System of Elements, Chemical Bonds, Forms of Substances, Energetics, Solutions, Colloid Systems, Chemistry. Carbon and Biochemistry, Everyday Chemicals, and instil a courageous, honest and responsible attitude. Learning is presented in the form of theory, practicum and assignments.

5. General Biology
   Understanding the basic concepts of biology as the science, structure and function of cells, metabolism which includes transport, photosynthesis and respiration, genetics, diversity of living things and nomenclature, the origin of life, evolution, structure of plant and animal organ tissue functions, ecology, behaviour of organisms and biotechnology, and practice solving problems through scientific methods. General

Biology studies are accompanied by various process skills (minds on activity and hands on activity) which will be used to solve problems in the field of Biology and its applications. Learning is delivered by presentation, discussion and practicum.

6. Indonesian Language
   Discussion on (1) the history, position and function of the Indonesian language; (2) critical reading; (3) the characteristics of scientific Indonesian; (4) EBI; (5) scientific work; (6) proposal writing; (7) research reports; (8) articles and papers; (9) editing; (10) citations and reference lists, and (11) presentations.

7. Basic mathematic
   Assessment of functions, limit functions, continuity of functions, derivatives of functions and their applications, integrals and their applications, and matrices for solving systems of linear equations.

8. Introductory of Education
   Study of the basic concepts of education, human nature and its development, nature and foundation of education, education as a system, the national education system, the foundation of education, teachers as a profession, educational problems, educational innovation in Indonesia, and character education.

9. Religion Education
   Providing provisions for the formation of a student's personality as a whole by making Islamic teachings as a basis for thinking, behaving, and behaving in scientific and professional development. A complete personality can only be realized if each student has faith and piety to Allah SWT. Faith and piety will only be realized if it is supported by the development of its elements, namely: insight / knowledge about Islam (Islamic knowledge), religious attitudes (religion dispositions), skills in carrying out Islamic teachings (Islamic skills), commitment to Islam (Islamic). commitment), self-confidence as a Muslim (moslem confidence), and proficiency in implementing religious teachings (Islamic competence). In the psycho-social constellation, either as individuals, family members, community members, or as Indonesian citizens. This subject upholds divine values, humanity, unity, deliberation and justice within the framework of Pancasila and NKRI. This lecture also integrates Anti-Corruption Education material and religious moderation. Lectures are carried out with a system of case study analysis, presentations and discussions, project assignments / problem solving (problem solving), and reflection.

10. Citizenship education
    This subject is an introduction to the nature of Civics which is continued by discussing the rights and obligations of citizens in accordance with the constitution in the context

of national identity, implemented democratically and based on applicable law. Then deepened by talking about law enforcement and Human Rights, Gender, Archipelago Insights, followed by National Resilience and ending on Anti-Corruption Education. Lectures are conducted using a case study analysis system, presentations and discussions, problem solving tasks, and reflection.

11. Digital Literacy

    This course provides students with an understanding of digital literacy, data processing including basic programming, finding and filtering information, using, finding and filtering information, using technology for collaboration, and creating technology-based content. All lecture activities will be carried out through discussions, information retrieval through ICT, practices using technology for collaboration, creating data processing programs, and projects to create information technology-based content. study of theories and mastery of skills about (1) culture, understanding the various contexts of digital world users; (2) cognitive, thinking power in assessing content; (3) constructive, namely the creation of something expert and actual; (4) communicative, namely understanding the performance of networks and communications in the digital world; (5) responsible confidence; (6) creative, doing new things in new ways; (7) critical in addressing the content; and (8) socially responsible. In this case, there are 3 levels in digital literacy development, namely: a. The first level, digital competence which includes skills, concepts, approaches, and behaviours; b. The second level is the use of digital which refers to the application of digital competencies related to a certain context; c. The third level is digital transformation which requires creativity and innovation in the digital world.

12. Mathematic for Science

    This subject discusses the understanding and application of basic mathematical concepts in the field of Science, in particular the application of mathematical models (vector, matrix, differential, integral, and differential equations) in Science and determining the solution analytically to support the development of science competence and its application. Learning is carried out with a Socrates question and answer strategy, case analysis.

13. Educational Psychology

    This course discusses the meaning, scope and contribution of educational psychology, student development, learning theories, aspects of personality that affect learning, learning difficulties, counselling at school, and classroom management for effective learning. Lectures are carried out using direct learning, independent assignments, and group discussions.

14. Introductory of Natural Science

    This course discusses the nature and scope of science, science as inquiry, Science Process Skills (KPS), aspects of science content, science functions in development thinking skills and scientific literacy.

15. Learning Theory

    Study of the principles and ways of students learning according to behavioural learning theory, social learning theory, cognitive learning theory, constructivist approach, and student motivation to learn; and its application in learning through analysis of class cases.

16. Basic Computer

    This subject discusses the introduction and understanding of the basics of computers which include hardware, software and applications in the form of Microsoft Word, Excel, PowerPoint, publishers that can support student tasks such as making handouts, web publications and simply processing and analyzing the results of educational assessment data. IPA. Lectures are carried out with modelling and practice / practicum.

17. Biodiversity

    This course discusses the life of microorganisms, for example prions, viruses, monera (, blue algae and bacteria) and macro, for example fungi, plants and animals, and their diversity, including classification principles, and representative examples in Indonesia, presented in theoretical form. and practice.

18. History and Philosophy of Education

    Assessing philosophy in the context of science and learning through critical analysis of the process of thinking and discovering science products by natural science philosophers / scientists including their justification from various learning sources / media that have evolved from time to time and their application in the context of science education based on the viewpoint of educational philosophy through critical analysis of education and science education problems / issues / policies so as to produce logical solutions and make decisions appropriately and responsibly. Presented in the form of theory and practice.

19. Curriculum Reviews

    This course examines the Study of the School Mathematics and Natural Sciences Curriculum which includes the understanding of the curriculum, curriculum documents, curriculum components, curriculum aspects, material analysis (misconceptions, prediction of material that is difficult for students or teachers to understand and material that is difficult in their learning), task analysis, and other

aspects of the applicable curriculum. This course is presented in theory and assignments.

20. Entrepreneurship

    Understanding the concept of entrepreneurship in an effort to develop an entrepreneurial spirit, namely the ability to motivate oneself to be able to perceive business opportunities, create services, production, marketing, partnerships and management, and be able to improve problem-solving skills in business.

21. Social and Culture Study

    Studies on the scope of ISBD, humans as cultural beings, humans as individuals and social, human and civilization, human beings, diversity and equality, human beings, values, morals and law, humans, science, technology, and art, as well as humans and the environment . In addition, it raises and studies various social and cultural problems that occur in society. Lectures are carried out using a case study analysis system, project assignments, presentations and discussions, and reflections.

22. Biomechanics

    This subject discusses the study of the motion of living things in terms of physics, biology, and chemistry; forms of motion, physical characteristics of motion and changes in motion of objects due to forces, growth and development of living things by phylogeny, as well as chemical energy that affects the processes of motion in living things in the form of theory and practice. Learning is delivered by presentation, discussion and practicum.

23. Plant Anatomy and Physiology

    The study of the structure, function, and development of higher plant organs in terms of morphological and anatomical characteristics. The study covers the structure and function in and development of plant cells, comparison with animal cells, meristem development to adult tissue, various tissues (structure, function, and development), structure, function, and development of organs in vascular plants including the structure of stem, root development. , leaves, fruit, and seeds and anomalies that occur in each organ.

24. Matters and Energy

    This course discusses the properties of a substance, temperature, heat & expansion, thermodynamics, the form of energy and its changes through theory & practice to solve problems and their application in everyday life.

25. Management and Work Safety in the Laboratory

    This subject discusses laboratory management and administration, work planning and

costs, laboratory work safety and security, solution preparation, laboratory work assessment, and preparation of SOPs.

26. Innovative Learning I

    This course discusses the study of learning models with directives (Direct Instruction), concept attainment, meaningful learning, and discussion (discussion models of learning), SET-oriented learning, and learning strategies (learning strategies). The assessment is carried out through the presentation of concepts, presenting operational examples of each learning model in the form of learning tools, workshops on developing learning tools by students oriented to each learning model and strategy. The study activity ended with an exercise in the implementation of a specific learning model by each student in forum peer teaching followed by discussion and reflection activities.

27. Animal Anatomy and Physiology

    This course aims to provide knowledge and skills about animal anatomy and physiology. In it, this course discusses the physiology of the human body in the context of comparison with animals in the vertebrate group. Learning begins with an introduction in the form of important terms. Furthermore, the lecture invites students to study the anatomy and physiology of organ systems (nervous, motion, cardiovascular, digestive, respiratory, uropoetic and urogenital), animal navigation systems, and embryonic development. Lectures are also supported by laboratory activities to make it easier for students to access knowledge about material that is generally abstract in nature. Others, learning opportunities outside of face-to-face lectures are provided in the form of structured assignments. On the topic of communication and navigation in animals, the main focus is on the processes and mechanisms of animal migration from one place to another within a certain time frame; range in vertebrates.

28. Fluid

    This course discusses the definition of fluids, the properties of fluids, pressure on solid and fluid objects, principles / laws of static fluids, specific properties of liquids, principles / laws of dynamic fluids, specific properties of gaseous fluids. , and solve application problems in the field of science such as blood pressure, diffusion in respiratory events, osmotic pressure. Lectures are carried out with modelling, presentations, discussions, and practicum.

29. Conservation of Natural Resources and the Environment

    Discusses: 1) The scope of conservation which includes: Definition, objectives, benefits and conservation efforts of natural resources and the environment (SDAL) 2) Environmental ethics which includes: Definition, Paradigm, and Environmental

Ethical Principles 3) Resources nature which includes: Definition, types and benefits of Natural Resources 4) Local wisdom which includes: Definition, approaches, challenges and local wisdom in community life in the future 5) Management and problems of natural resources and the environment which include: issues, problems and management of natural resources and the environment. 6) Conscious conservation which includes awareness of the importance of conserving natural resources and the environment, an eco-campus and a conservation campus. Lecture activities are carried out by discussion, observation, project assignments, and presentations.

30. Introduction to Biochemistry
    Assessing the role of nutrients as a source of energy through understanding the structure, function, and biochemical reactions of nutrients, so as to provide ideas for the prevention of metabolic disorders.

31. Learning Media
    Study of the definition, type / classification, function, basics of media development, as well as being able to select, design, and produce learning media by utilizing the surrounding environment (contextual) and ICT.

32. Assessment and evaluation
    This course examines the concepts and principles of assessment processes and learning outcomes including terminology and understanding, taxonomy of learning outcomes, assessment principles, assessment strategies (paper & pencil and alternative assessment) and forms of assessment, rubric, development steps, criteria. the quality of the assessment instruments, item analysis, and interpretation of the assessment results. This subject is presented in theory and assignments to develop instruments that are adequate with affective, cognitive, psychomotor and process learning outcomes.

33. Internship I
    In this subject, students carry out teaching exercises through learning simulation activities and microteaching.

34. Innovative Learning II
    Study of learning models: cooperative learning, scientific approach-oriented learning such as: problem-based learning (problem-based learning), inquiry-discussion learning and contextual learning and project-based learning. The assessment is carried out through the presentation of concepts, the presentation of operational examples for each learning model in the form of learning tools, workshops on developing learning tools by students oriented to each learning model and strategy. The study activity ends with an exercise in the implementation of a specific learning model by each student in forum peer teaching followed by discussion and reflection activities.

35. SETS

    Assessing environmental problems or community issues through identification, finding alternative solutions, and developing inventions / innovations based on science, environment, technology, and society in the form of project assignments, preparation of reports, and PKM-AI / PKM-GT proposals.

36. Ecology

    Understand, and communicate the basic concepts of Ecology regarding: understanding and application of the principles and concepts of ecosystems, individuals, populations, communities, ecosystems; vegetation: productivity, succession: environmental factors, biomes, tropical terrestrial vegetation; tolerance range, time-temperature concept; food relations: ecological niches; growth parameters; interaction and regulation; population interaction and regulation, and conservation. Presented in the form of theory and practice.

37. Solution

    This course discusses the concept of solution, concentration, electrical properties, acid-base, buffer solutions and their application in life, hydrolysis, colligative properties and the use of colloids in life through theoretical studies and also practice by exploring more sources of information through existing information media. Presented in the form of theory and practice.

38. Living at Cellular Level

    The study of life at the cellular level includes the structure and function of cells and cell organelles, the structure and function of the plasma membrane, the structure and biological function of proteins and nucleic acids, the mechanisms of protein synthesis, cell growth and proliferation, and differentiation and determination carried out through theoretical studies and discussions.

39. Electricity and Magnetism

    This subject discusses static electricity, dynamic electricity, magnetism, electromagnetic induction, alternating current electricity, and introduction to electromagnetic waves. The lectures are carried out with modelling, presentations, discussions, and practicum.

40. Research method

    This subject examines research paradigms, research approaches, types of research, studies of recent research articles, hypotheses, variables, research designs, research instruments, research techniques, data analysis and interpretation of research results, as well as the steps for preparing proposals and research report. This subject is

presented in theory and an assignment for the preparation of an educational research proposal as the final product of the course.

41. Introductory of Electronics
    This course discusses the theory of semi-conductors, extrinsic types p and n and p and n connections, diodes, transistors as resistances and switches, power amplifiers, op-amps, oscillators, digital electronics, and logic circuits. Lectures are carried out with modelling, presentations, discussions, and practicum.

42. Statistics of Education
    The Education Statistics course is a compulsory subject for S1 Science Education study program students. After attending this course, students are expected to have the knowledge and skills to apply statistical principles in science education research through data collection, data analysis and presentation, communication of research results and scientific publications.

43. Science School Analysis
    Analysis of the dimensions of knowledge on the SPM Basic Competencies of Natural Sciences (IPA), including the potential for misconceptions. Lectures are conducted with presentations, discussions, and assignments.

44. Waves and Optics
    This course examines the basics of vibrations, waves, light, optical devices and their application in everyday life, presented in the form of theory and practice.

45. Atom and Radioactivity
    This course discusses the atomic structure, symptoms of radioactivity, decay, half-life, binding energy, fission and fusion reactions, and elementary particles.

46. Seminar
    Utilizing science and technology as a problem solving tool, as well as communicating ideas and findings in the field of science education. Mastering the basics of making articles in science education that reflect the ability of reasoning to formulate procedural problem solving in science education. Make strategic decisions based on data and information. Including the results of input, ideas, ideas, colleagues, colleagues, references, and provide ideas for choosing various alternative solutions. Responsible for the task of making and presenting seminar papers and articles.

47. Earth and Planetary Sciences
    This course discusses physical phenomena on earth and space, including: the structure of the earth, the lithosphere, the atmosphere, the solar system and other celestial

bodies, and analyzes the theory of the evolution of the universe.

48. KKN
    In this subject, students carry out activities and community service to learn and apply the knowledge obtained from the campus in real community life.

49. Household Chemistry
    Understanding of various household chemicals, additives in food, addictive substances (psychotropic), in terms of their uses and side effects on the body and the environment.

50. Review of Science Research Findings
    Discussion of at least 5 recent articles (last 5 years) published through international journals (4 articles) and those published through nationally accredited journals (1 article) that are relevant to student thesis research ideas through tracing, analysis, summary, preparation, and presentation activities.

51. Internship II
    This course is a continuation of internship 1 with an apprenticeship and carrying out real learning in partner schools guided by supervisors.

52. Ethno science
    This subject discusses "public science" and scientific science, methods to explore "social science" to be interpreted as scientific science, develop it, and reflect on the results of development. Learning is carried out in the form of case studies, discussions and experimentation.

53. Introductory of Biotechnology
    This subject discusses the study and development of reasoning on the principles of biotechnology including fermentation biotechnology, industrial biotechnology, genetic engineering, primary metabolites, secondary metabolites, and tissue culture by integrating entrepreneurial perspectives. Lectures are carried out with modelling, presentations, discussions, and practicum.

54. Thesis
    This subject is a compulsory subject that must be followed by all students as a final project for the completion of undergraduate studies. The stages that must be followed are: preparation of research proposals, seminar proposals, revision of proposals, data collection, data analysis, preparation of discussions, preparation of conclusions, and draft thesis and thesis examination.