Faculty of Mathematics and Natural Sciences
Universitas Negeri Yogyakarta
Ministry of Higher Education, Science, and Technology

CURRICULUM BACHELOR OF EDUCATION IN NATURAL SCIENCE STUDY PROGRAMME

Kampus Karang Malang Yogyakarta
www.pendidikan-ipa.fmipa.uny.ac.id/id

COORDINATOR OF STUDY PROGRAM'S FOREWORD

Praise be to God Almighty for His grace and grace, the curriculum document of the IPA FMIPA UNY Education Study Program can be compiled as well as possible. This curriculum is prepared as a guideline or academic guide designed to answer global challenges that produce graduates who are superior, creative, innovative and globally competitive, in accordance with the vision of Yogyakarta State University and the Faculty of Mathematics and Natural Sciences UNY. This curriculum is designed to realize the vision of the Science Education Study Program through a holistic learning approach, prioritizing critical thinking skills, collaboration, and strengthening local wisdom values. Thus, graduates not only master the scientific content of science, but are also able to apply it in an ever-evolving global context.

As a study program that produces prospective science teachers for the junior high school/MTs level, we realize the importance of preparing educators who are adaptive to the dynamics of 21st century education. This curriculum combines strengthening the basic concepts of science with the development of creative learning methods, the use of technology, and the integration of local potential in teaching materials. It is hoped that graduates can become inspirational teachers, able to foster students' interest in science, and contribute to the progress of national education.

The preparation of this curriculum document is the result of collaboration among lecturers, education practitioners, stakeholders, and other relevant parties, who provided meaningful input. We also conduct periodic reviews to ensure that the curriculum remains responsive to the changing times and the evolving needs of the educational world. Support from various parties, including the government, partner schools, and professional organizations, is an important capital in enriching the quality of these documents.

We recognize that this curriculum document is still open for refinement, tailored to the development of Education and higher education science and policy. Therefore, suggestions and inputs from various parties are highly expected for future improvements. We hope that the curriculum of the FMIPA UNY IPA Education Study Program can be a strong foundation in producing science teachers who are professional, characterful, and ready to face future challenges. Hopefully this document will be an effective guide in the implementation of Education in the Science Education Study Program in realizing quality and sustainable science education.

Sincerely,
Coordinator of the Science Education Study Program
FMIPA UNY

List Of Contents

A. Vision, Mision, and Objective of The study Programe

1. Scientific Vision of the Study Programe

Developing science education science based on the integration of science, technology, and local potential to produce graduates who are superior, creative and innovative, sustainable and globally competitive..

2. Misi Program Studi

a. Organizing education and teaching in the field of science education and science that is superior, creative, and innovative in a sustainable manner through the integration of science, technology, and local potential to produce competent and globally competitive graduates.
b. Develop research in the field of Science Education based on the integration of science, technology, and local potential to support the advancement of science and educational practice.
c. Applying research results through science, technology-based programs and utilizing local potential to improve the quality of life of the community.
d. Building collaboration with educational institutions, government, industry, and society in the context of sustainable scientific development and practice of Science Education.
e. Integrate the values of local wisdom and the latest technology in the curriculum and learning process to create graduates who are adaptive and relevant to the needs global.

3. Study Programe Objective

a. Formulation of Study Programe Objective
    1) Producing graduates who are superior, creative, and innovative in the field of science education, by integrating science, technology, and local potential to become competent and globally competitive prospective educators and scientists.
    2) Develop research in the field of Science Education based on the integration of science, technology, and local potential to support scientific progress and quality educational practices.

3) Implementing science and technology-based research, as well as utilizing local potential in the form of community service that has a direct impact on science literacy, quality based on local potential.
4) Collaboration in the field of science education both at the national and international levels to expand horizons and increase global competitiveness.
5) Integrating the integrated values of local wisdom and the latest technology to create graduates who are superior, creative, and innovative, sustainable and relevant to global needs.

B. Graduate Profile and Profile description

1. Graduate Profile and Profile Description

The profile of graduates of the S1 Science Education Study Program FMIPA UNY, is as (1) science educators for junior high schools/MTs and vocational schools, (2) research assistants in the field of Science Education, and (3) managers of classroom resources, laboratories, schools, or educational institutions as shown in Table 5

Table 5. Graduate Profile and Profile Description

Graduate profile	Profile description
Prospective Science Educator	Graduates can be prospective science educators for junior high school/MTs and vocational school levels
Research Assistant for Science Education	Graduates have the ability to be research assistants in the field of science education
Classroom, Laboratory, School, or Educational Institution resource manager.	Graduates have the ability to be Resource Managers of Classrooms, Laboratories, and Schools, or Educational Institutions both formal and non-formal

C. Programe Learning Outcome

1. Formulation of Programe Learning Outcome (PLO)

Graduate Competency Standards are stated as learning outcomes as shown in Table 7.

Tabel 7. PLO Bachelor of Education in Science

No	Program Learning Outcomes
PLO-1	Demonstrate behaviour as good citizens based on religious and belief values, cultural values, and humanitarian values, and show respect for diversity in society
PLO-2	Apply good ethics in working independently or in teams with a scientific, critical, creative, innovative, and sportsmanlike attitude, and commit to continuous self-development
PLO-3	Analyze and apply science concepts (physics, biology, chemistry, earth and space science) in analyzing natural phenomena and science-based problem solving
PLO-4	Analyze the fundamental concepts of education and pedagogy that support the implementation of education and the design of creative, adaptive, and innovative science learning
PLO-5	Utilize and evaluate current and relevant information and communication technology to support the development of innovative science learning and the improvement of science education quality
PLO-6	Apply relevant and up-to-date science education research methodologies to produce scientific work
CPL-7	Apply science and technology in science education effectively, adapting to and overcoming challenges in problem solving
CPL-8	Conduct scientific procedures systematically in science research and learning, while adhering to safety principles and research ethics
PLO-9	Produce innovative, research-based products in science education that utilize local potential in a creative, responsible, and ethical manner
PLO-10	Apply science and science education concepts and principles in designing and developing relevant entrepreneurial activities in a creative and responsible way
PLO-11	Communicate the results of science and science education research effectively and professionally

D. Curriculum Stucture

The curriculum of the Science Education Study Program consists of the following types of courses: Compulsory Curriculum Courses (MKWK), University Compulsory Courses (MKWU), Faculty Courses (MKF), Scientific Foundation Courses of the Study Program (MKPKP), Educational Basic Courses (MKDK), Learning Process Skills Courses (MKKPP), Off-Campus Learning Courses (MKPLK), Scientific Development Courses (MKPK), Additional Competency Courses (MKTK)

Tabel 12. Course Groups and Credit Distribution for Bachelor of Education

No	Course Category	Min. Credits	Max. Credits
1	Compulsory Curriculum Courses (MKWK)	8	8
2	University Compulsory Courses (MKWU)	6	6
3	Faculty Courses (MKF)	4	10
4	Scientific Foundation Courses of the Study Program (MKPKP)	77	80
5	Educational Basic Courses (MKDK)	10	10
6	Learning Process Skills Courses (MKKPP)	10	10
7	Off-Campus Learning Courses (MKPLK)	12	20
8	Scientific Development Courses (MKPK)	11	11
9	Additional Competency Courses (MKTK)	8	8
	Total Credits	**149**	**160**

Tabel 13. *Compulsory Curriculum Courses*

No	Code	Course	SKS				SEM*)		Prequisite
			T	P	L	J	Gs	Gn	
1	MWK60201	Islamic Education*	2	-	-	2	1 *)		-
	MWK60202	Catholic Education*	2			2			
	MWK60203	Christianity Education*	2			2			
	MWK60204	Hinduism Education*	2			2			
	MWK60205	Buddhist Education*	2			2			
	MWK60206	Confucian Education*	2			2			
2	MWK60207	Civic Education	2			2	1		
3	MWK60208	Pancasila	2			2		2	
4	MWK60209	Bahasa Indonesia	2			2		6	

Table 14.University Compulsory Courses

No	Kode	Course	sks				Semester		Prasyarat
			T	P	L	J	Gs	Gn	
1	MWU60201	English for Specific Purposes	2	-	-	2		2	
2	MWU60202	Sports and Physical Fitness	-	2	-	2		6	
3	MWU60203	Education and Sustainable Development	2	-	-	2	5		
						6			

Tabel 15. Faculty Courses

No	Kode	Course	sks
1.	FMI60201	Science Perspective and Review	2
2.	FMI60202	Basic Statistics	2
			4

Tabel 16. Educational Basic Courses

Kode		Sks
MWP60201	Educational Science	2
MWP60202	Educational Psychology	2
MWP60203	Educational Management	2
MWP60204	Sociology and Anthropology of Education	2
MWP60205	Inclusive Education	2
		10

Table 17. Science Learning Process Skills Courses (MKKPP) (for Education Study Programs)

Kode	Course	Sks
SPI60201	Curriculum and Science Learning	2
SPI60202	Science Learning Models	2
SPI60203	Science Learning Media	2
SPI60204	Science Learning Assessment	2
SPI60205	Science Microteaching	2
		10

Table 18. Off-Campus Learning Courses

Kode	**Course**	sks
MLK60601	Educational Practice	6
MLK60605	Community Service	6

Table 19. Scientific Development Courses

Code	**Course**	**SKS**
MKK60301	Research Methodology	3
MKK60801	Final Project	8
		11

Table 20. Scientific Foundation Courses of the Study Program

Kode	Course	SKS
SPI60206	Mathematics for Science	2
SPI60301	Basic Science	3
SPI60302	General Biology I	3
SPI60303	General Chemistry I	3
SPI60304	Basic Physics I	3
SPI60207	Measurement Tools and Methods in Science	2
SPI60305	General Biology II	3
SPI60306	General Chemistry II	3
SPI60307	Basic Physics II	3
SPI60308	ICT in Science Learning	3
SPI60309	School Science Study I	3
SPI60208	Strategy and Management in Science Learning	2
SPI60310	Earth and Space Science	3
SPI60209	Environmental Science	2
SPI60210	Chemistry in Daily Life	2
SPI60311	Science Laboratory Management and Techniques	3
SPI60312	School Science Study II	3
SPI60313	Structure and Function of Plants	3
SPI60211	Waves and Optics	2
SPI60212	Biotechnology	2
SPI60213	Local Wisdom in Science Learning	2
SPI60314	Structure and Function of Animals	3
SPI60214	Applied Science	2
SPI60215	STEM	2
SPI60216	Electricity and Magnetism	2
SPI60217	Videography	2
SPI60315	School Science Study III	3
SPI60218	Biophysics	2
SPI60316	Integrated Science and Learning	3
SPI60219	Industrial Science and Culture	2
SPI60220	Sciencepreneur	2
SPI60221	Scientific Publication in Science Education	2
		80

Table 21. Additional Competency Courses (MKTK)

Kode		SKS
SPI60222	Mecanics and Fluids *)	2
SPI60223	Chemistry Skills *)	2
SPI60224	Soil Science *)	2
SPI60225	Biochemistry *)	2
SPI60226	Thermodynamics *)	2
SPI60227	Modern Physics *)	2
SPI60228	Genetics and Inheritance *)	2
SPI60229	Nutrition and Health Science *)	2
SPI60230	Earth Science *)	2
SPI60231	Biodiversity *)	2
SPI60232	Item Response Theory *)	2
SPI60233	Competency and Professional Development *)	2
SPI60234	Science Education Research Study *)	2
SPI60235	School-Based Management *)	2
SPI60236	Science Education for Sustainability *)	2
SPI60237	Scientific Computing *)	2
SPI60238	Programming and Robotics *)	2
SPI60239	Applied Statistics *)	2
SPI60240	Astronomy *)	2
SPI60241	Computer-Based Learning Media *)	2
		40

*) A maximum of 8 credits can be taken from the 40 credits of Additional Competency Courses.

E. Distribution of Course per semester

Semester 1

No	Code	Course	T	P	L	Amount	Prerequisite
1	MWK60201	Islamic Education*	2			2	
	MWK60202	Catholic Education*					
	MWK60203	Christianity Education*					
	MWK60204	Hinduism Education*					
	MWK60205	Buddhist Education*					
	MWK60206	Confucian Education*					
2	SPI60206	Mathematics for Science	2			2	
3	SPI60301	Basic Science	2	1		3	
4	SPI60302	General Biology I	2	1		3	
5	SPI60303	General Chemistry I	2	1		3	
6	SPI60304	Basic Physics I	2	1		3	

No	Code	Course	T	P	L	Amount	Prerequisite
7	SPI60207	Measuring Instruments and Measurement Methods in Science	1	1		2	
8	MWP60201	Educational Science	2			2	
		Total credit semester (max 20 sks)				20	

Semester 2

No	Code	Course	T	P	L	Amount	Prerequisite
1	MWK60208	Pancasila	2			2	
2	MWU60201	English for Specific Purposes	2			2	
3	SPI60201	Science Curriculum and Instruction	2			2	
4	SPI60202	Science Learning Models	2			2	
5	SPI60305	General Biology II	2	1		3	SPI60302
6	SPI60306	General Chemistry II	2	1		3	SPI60303
7	SPI60307	Basic Physics II	2	1		3	SPI60304
8	SPI60308	ICT in Science Learning	2	1		3	
		Total credit semester (max 20 sks)				20	

Semester 3

No	Code	Course	T	P	L	Amount	Prerequisite
1	FMI60202	Basic Statistics	2			2	
2	SPI60309	School Science Study I	2	1		3	
3	SPI60208	Planning of Science Learning	1	1		2	SPI60202
4	SPI60310	Earth and Space Science	2	1		3	
5	SPI60209	Environmental Science	2			2	SPI60305
6	SPI60210	Chemistry in Everyday Life	2			2	SPI60306
7	SPI60311	Science Laboratory Management and Techniques	2	1		3	
8	MWK60207	Civic Education	2			2	
9	MWP60202	Educational Psychology	2			2	
10		Elective Course	2			2	
		Total credit semester (max 24 sks)				23	

Semester 4

No	Code	Course	T	P	L	Amount	Prerequisite
1	SPI60312	School Science Study II	2	1		3	SPI60309
2	SPI60203	Science Learning Media	1	1		2	
3	SPI60204	Assessment in Science Learning	2			2	SPI60208
4	SPI60313	Plant Structure and Function	2	1		3	SPI60302 SPI60305
5	SPI60211	Waves and Optics	2			2	SPI60304 SPI60307

No	Code	Course	T	P	L	Amount	Prerequisite
6	MWP60204	Sociology and Anthropology of Education	2			2	
7	MWP60205	Inclusive Education	2			2	
8	SPI60212	Biotechnology	2			2	
9	FMI60201	Science Perspective and Review	2			2	
10		Elective Course	2			2	
		Total credit semester (max 24 sks)				22	

Semester 5

No	Code	Course	T	P	L	Amount	Prerequisite
1	MWU60203	Education and Sustainable Development	2			2	
2	SPI60213	Local Wisdom in Science Learning	2			2	SPI60208
3	SPI60314	Animal Structure and Function	2	1		3	SPI60305
4	SPI60214	Applied Science	1	1		2	SPI60301
5	SPI60215	STEM (Science, Technology, Engineering, Mathematics)	2			2	
6	SPI60216	Electricity and Magnetism	2			2	SPI60307
7	SPI60217	Videography	1	1		2	SPI60308
8	SPI60315	School Science Study III	2	1		3	SPI60312
9	SPI60218	Biophysics	2			2	SPI60304 SPI60302 SPI60307 SPI60305
		Elective Course				2	
		Total credit semester (max 24 sks)				22	

Semester 6

No	Code	Course	T	P	L	Amount	Prerequisite
1	MWU60202	Sports and Physical Fitness	1	1		2	
2	MWK60209		2			2	
3	SPI60316	Integrated Science and Its Learning	2	1		3	SPI60208
4	SPI60219	Culturally Based Industrial Science	2			2	
5	SPI60220	Sciencepreneur	1	1		2	
6	MKK60301	Research Methodology	2	1		3	FMI60202
7	SPI60205	Microteaching in Science		2		2	SPI60208
8	MWP60203	Educational Management	2			2	
		Elective Course				2	
		Total credit semester (max 24 sks)				20	

Semester 7

No	Code	Course	T	P	L	Amount	Prerequisite
1	SPI60221	Scientific Publication in Science Education	1	1		2	MKK60301
2	MLK60605	Community Service			6	6	
3	MLK60601	Educational Practice			6	6	
		Total credit semester (max 24 sks)				14	

Semester 8

No	Code	Course	T	P	L	Amount	Prerequisite
1	MKK60801	Undergraduate Final Project (Thesis)			8	8	MKK60301
		Total credit semester (max 24 sks)				8	

F. Course Description

Code	MWK60208
Course Credit	2
Course Name	Pancasila
Description	This course discusses the foundations and objectives of Pancasila, Pancasila as a result of scientific thinking, Pancasila in the context of the Indonesian national struggle, Pancasila as a system of values and national ideology, the Constitution and its amendments, and Pancasila as a paradigm for social, national, and state life.
CLO	1. Demonstrates a positive attitude toward Pancasila as the foundation of the state and the nation's worldview (PLO-1) 2. understands the scientific-philosophical truths contained in Pancasila based on the values of cooperation and responsibility (PLO-1, PLO-2) 3. understands historical events and the values of nationalism and national culture to foster Indonesian unity and has a visionary outlook on the life of the nation (PLO-1) 4. analyzes the comparison between the Pancasila ideology and other ideologies (religious ideology, liberalism, communism) (PLO-4) 5. Analyze the dynamics of the implementation of the Constitution in Indonesia and the amendments to the 1945 Constitution (PLO-1) 6. To demonstrate integrative, comprehensive, and solution-oriented thinking in addressing issues related to national and civic life, grounded in the values of honesty, tolerance, responsibility, and empathy. (PLO-1, PLO-2, PLO-7)

Code	FMI60202
Course Credit	2
Course Name	Insights and Studies in Mathematics and Natural Sciences
Description	This course covers the basic methods of science (scientific methods) in problem-solving and the methods/techniques for drawing conclusions based on sound reasoning principles (mathematical logic). The study also includes the fundamental concepts of science and current developments.

CLO	1. Explaining the fundamental concepts of Mathematics and Natural Sciences (MIPA) in an interdisciplinary manner, and drawing analogies with natural phenomena on both macro and micro scales to develop a holistic understanding of the interconnections among the natural sciences (PLO-3, PLO-7, PLO-8). 2. Applying the principles of mathematical logic and scientific reasoning (*Modus Ponens*, *Modus Tollens*, syllogism) in constructing valid scientific arguments, testing the consistency of propositions, and drawing conclusions based on data in a logical and systematic manner (PLO-2, PLO-6, PLO-11). 3. Demonstrate the complete steps of the scientific method, including problem formulation, experimental design, data collection and analysis, and interpretation of results based on the principles of objectivity, replicability, and falsification (PLO-6, PLO-9). 4. Integrate statistics in STEM research, including sampling techniques, quantitative/qualitative data processing, descriptive-inferential statistical analysis, and visual presentation of results to support the validity of scientific findings (PLO-5, PLO-6, PLO-11). 5. Explaining the role and contribution of Mathematics and Natural Sciences (MIPA) in technological development, multidisciplinary innovation, and global problem-solving (in the fields of environment, health, and energy) by referring to examples from current research (PLO-7, PLO-10). 6. Compose ethical and high-quality scientific works, including the application of correct writing structures, citation and paraphrasing techniques, plagiarism detection, and maintaining academic integrity in the presentation of ideas and research results (PLO-1, PLO-2). 7. Demonstrate a responsible and independent attitude in completing scientific task and reflect on the philosophical values of science (ontological, epistemological, axiological) as the foundation of academic and professional practice (PLO-2, PLO-9).

Code	FMI60202
Course Credit	2
Course Name	Basic Statistics
Description	This course covers basic statistical concepts, including types of data and measurement scales, data presentation and summarization, probability concepts, and various probability distributions, both discrete and continuous. Students will also learn parameter estimation and inferential analysis techniques such as hypothesis testing (one-sample t-test, independent-sample t-test, paired t-test, and ANOVA), correlation, and linear regression, as well as the application of statistics in logically and systematically solving contextual problems in education.
CLO	1. Explain basic statistical concepts, types of data, and measurement scales in the context of research and education (PLO-6). 2. Present and analyze data descriptively through tables, graphs, measures of central tendency, and measures of dispersion accurately and informatively (PLO-6, PLO-7). 3. Understand and apply probability concepts including sample space, types of events, and basic operations in probability such as the "and" (intersection) and "or" (union) relationships. In addition, students are also able to understand and apply the concept of conditional events in solving various data analysis problems in the field of science (PLO-6). 4. Discrete distributions include binomial, multinomial, hypergeometric, and Poisson distributions, which are used to describe discrete or limited events. Meanwhile, continuous distributions include the normal distribution (Z), Student's t-distribution (T), Chi-Square distribution (χ^2),

	and Fisher's F-distribution, which are widely used in hypothesis testing and analysis of variance (PLO-6). 5. Performing population parameter estimation through inferential statistical techniques. Students can distinguish and apply point estimation and interval estimation to population parameters, such as mean, proportion, and variance, based on sample data (PLO-6, PLO-8). 6. Performing and interpreting the results of hypothesis testing using the following techniques: One-sample t-test, Independent samples t-test, Paired samples t-test, Analysis of Variance (ANOVA) (PLO-6, PLO-7, PLO-8). 7. Apply correlation and simple and multiple linear regression analysis to evaluate the relationship between variables (PLO-6, PLO-8). 8. Integrating statistical analysis results into logical, systematic, and applied contextual problem-solving in the field of education and the use of computer technology for problem-solving with statistics (PLO-7, PLO-8).

Basic Education Courses (for Education Programs)

Code	MWP60201
Course Credit	2
Course Name	Educational Science
Description	This course is compulsory for all students enrolled in education study programs at UNY. As preparation for prospective educators to become professional teachers, this course covers various studies on the basic principles of education and the fundamental concepts of educational science and their application in educational practice, including: educational phenomena, the nature of education and educational science, the foundations of education, the principles of education, education as a science and system, educational issues and problems, learning theories, and lifelong education.
CLO	1. Provides an in-depth discussion of the concepts, principles, and teachings of education from classical and modern educational science experts (PLO-4, PLO-1). 2. Maps the figures in educational science that have developed (PLO-4, PLO-1). 3. Distinguishing assumptions, concepts, and principles in education that have developed in the field of educational science (PLO-4, PLO-3). 4. Using assumptions, concepts, and principles of education to explain the reality of educational implementation in society (PLO-4, PLO-7).

Code	MWP60202
Course Credit	2
Course Name	Educational Psychology
Description	This course presents the basic concepts of Educational Psychology, including the importance of educational psychology, individual development, individual differences, socio-cultural diversity, learners with learning difficulties, various approaches to learning, complex cognitive processes, motivation, classroom management, and learning evaluation.
CLO	1. Understanding the importance of applying educational psychology in learning in the 4.0 era. (PLO-4, PLO5). 2. Understanding cognitive, emotional, social, and moral development in adolescents (PLO-4). 3. Understanding individual differences and their implications in learning

	(PLO-4, PLO1). 4. Understanding social and cultural differences in learning (PLO-4, PLO1). 5. Understanding the conditions of students experiencing learning difficulties (PLO-4, PLO7). 6. Understanding various learning approaches or theories (PLO-4). 7. Understanding complex cognitive processes (PLO-4, PLO3). 8. Understanding motivation in learning (PLO-4, PLO2). 9. Evaluating the learning environment and improving it (PLO-7, PLO5). 10. Understanding various types of learning evaluation (PLO-4, PLO5).

Code	MWP60203
Course Credit	2
Course Name	Education Management
Description	The Educational Management course is a university-level course and is mandatory for all education program students, carrying a weight of 2 Course Credit. This course covers the basic concepts and implementation of educational management, including: the national education system, students, curriculum, educational staff, educational facilities, education funding, institutional administration, and the relationship between educational institutions and the community, as well as educational leadership and supervision.
CLO	1. Organizing and managing students (PLO-4, PLO-7). 2. Organizing and managing the curriculum (PLO-4, PLO-5). 3. Organizing and managing educational personnel (PLO-2, PLO-7). 4. Organizing and managing educational facilities (PLO-5, PLO-7). 5. Organizing and managing educational funding (PLO-10, PLO-7). 6. Organizing and managing the administration of educational institutions and their relationships with the community (PLO-1, PLO-7). 7. Organizing and managing educational leadership (PLO-2, PLO-7). 8. Organizing and managing educational supervision (PLO-11, PLO-7).

Code	MWP60204
Course Credit	2
Course Name	Sociology and Anthropology of Education
Description	This course discusses education as a socio-cultural process. This course provides foundational knowledge about the importance of climate, approaches, and socio-cultural influences, both from school and outside school (family, peer groups, society, and media) in a multicultural (pluralistic) society and education that is most suitable for Indonesian humans (anthropos) in realizing the current and future goals of Indonesian national education.
CLO	1. Mastering and mapping the concepts of sociological and anthropological theories of education (PLO-4). 2. Distinguishing various methodologies and using them to analyze educational phenomena (PLO-6, PLO-8). 3. Demonstrate sensitivity to contextual educational issues (PLO-1, PLO-7). 4. Analyzing various educational issues from a sociological and anthropological perspective (PLO-4, PLO-7).

Code	MWP60205
Course Credit	2
Course Name	Inclusive Education

Description	The Inclusive Education course covers the concepts, history, philosophy, foundations, principles, and practices of inclusive education. This course examines inclusive learning systems and processes, the learning characteristics of students with special needs, the principles and procedures for teaching students with special needs, and the concepts of inclusive education-based implementation, curriculum, and learning activities.
CLO	1. Mastering in depth the theoretical concepts, philosophy, principles, foundations, and types of inclusive education services, as well as the noble values of Indonesian educational culture; 2. Understand the practice of implementing inclusive education. 3. Having sensitivity to the importance of changing attitudes and personalities to socialize collaboration in supporting the success of inclusive education and realizing the responsibility as a teacher who understands the implementation of inclusive education

Course on Learning Process Skills (MKKPP) (for Education Programs)

Code	SPI60201
Course Credit	2
Course Name	Science Curriculum and Instruction
Description	This course equips students with the knowledge to master curriculum studies, including concepts, history, and rationalization of curriculum changes, curriculum models, analysis of the relationship between curriculum and learning, the current science curriculum for junior high schools, science curriculum standards from various countries, and a comparative analysis of science curricula in Indonesia and other countries.
CLO	1. Understand curriculum concepts through discussion and literature review (PLO-4). 2. Understanding the history of curriculum in Indonesia and the rationale for its changes through discussion (PLO-4). 3. Understanding curriculum models through discussion and presentation (PLO-4). 4. Analyzing the relationship between curriculum and learning through discussion and presentation (PLO-2, PLO-4, PLO-8). 5. Able to understand and develop planning for the current junior high school science curriculum through literature review, discussion, and presentation (PLO 2, PLO 4, PLO 8). 6. Able to analyze science curriculum standards in various countries through discussion and presentation (PLO 8). 7. Being able to compare science curriculum standards from various countries with the science curriculum in Indonesia through discussions and presentations (PLO-8).

Code	SPI60202
Course Credit	2
Course Name	Science Learning Model
Description	This course is a foundational course designed to help students understand and select appropriate learning models before proceeding to the design and implementation phases of science education. Students will analyze and evaluate the conceptual theories of various approaches, strategies, methods, techniques, tactics, and learning models in the context of science education. Students are guided to understand the characteristics, theoretical foundations,

	principles, advantages, and limitations of each relevant and current method, approach, and learning model in science education. The focus of study includes innovative learning models such as inquiry, discovery, PBL, PjBL, contextual, and the latest learning models that can be integrated with local potential and technology. In addition, students are guided to review and analyze journals and case studies of the implementation of science learning models.
CLO	1. Explaining the meaning, characteristics, and relationships between approaches, strategies, methods, techniques, tactics, and learning models in the context of science education (PLO 4). 2. Analyzing learning theories and pedagogical foundations that underlie various science learning models (PLO-4, PLO-3). 3. Examine the principles and application of various learning models such as inquiry, discovery learning, PBL, PjBL, CTL, and the latest learning models in the context of science learning (PLO-4, PLO-7). 4. Evaluate the advantages, limitations, and suitability of learning models with the characteristics of science material, students, and local and global contexts (PLO-4, PLO-5, PLO-9). 5. Demonstrating a scientific, critical, creative, and open-minded attitude in discussions, literature reviews, and case study analyses related to the application of science learning models (CPL-2, CPL-4). 6. Utilizing current learning resources and information technology in examining science learning models (PLO-5, PLO-7).

Code	SPI60203
Course Credit	2
Course Name	Science Learning Media
Description	This course discusses the nature, function, and role of media in science learning, as well as its relationship with learning objectives, material characteristics, students, and learning contexts. Students learn the principles of selecting, developing, and using media that are representative of science objects and phenomena, including the principles of visualization and representation of abstract concepts into concrete ones. The media developed include realia, visual media (including pop-up media), three-dimensional (3D) models, media from used items, simple science kits or teaching aids, Student Worksheets (LKPD), and science learning modules. Through a project-based and collaborative approach, students are trained to design and produce learning media in a creative, contextual, and innovative manner in accordance with the appropriate media development model (such as ADDIE, ASSURE, or 4-D). Students are also involved in the process of reflecting on and evaluating media based on limited usability tests and compiling scientific development reports. In the process, students are expected to demonstrate critical, scientific, communicative, and inclusive attitudes, as well as respect for cultural diversity and local potential as part of strengthening the professional ethics of science educators.
CLO	After completing this course, students are expected to be able to: 1. Explain the nature, function, selection principles, and relationship of science learning media with the objectives, material, and characteristics of students (PLO-3, PLO-4, PLO-7). 2. Analyze the forms of representation of science objects and phenomena in various types of media such as realia, visuals, 3D models, and media based on local potential (PLO-4, PLO-7). 3. Design creative, contextual science learning media that are in accordance with media development principles using appropriate development approaches or models (ADDIE, 4D, ASSURE, etc.) (PLO-5, PLO-9, PLO-10). 4. Creating and implementing science learning media such as pop-ups, teaching aids from used items, worksheets, and science learning modules (PLO-5, PLO-10). 5. Evaluate science learning media based on usability, effectiveness, and

	achievement of science learning objectives (PLO-7, PLO-8, PLO-9). 6. Demonstrate professional ethics, scientific attitude, inclusiveness, and social responsibility in developing media that takes into account cultural diversity, religion, and human values (PLO-1, PLO-2). 7. Communicate the results of science learning media development in the form of written reports and/or scientific presentations individually or in groups (PLO-11).

Code	SPI60204
Course Credit	2
Course Name	Science Learning Assessment
Description	This course discusses the basic concepts of measurement and evaluation in science education, including principles and assessment techniques relevant to the characteristics of science. The material covers the cognitive, affective, and psychomotor domains of taxonomy, the development of indicators and test items, the development of testing instruments, and the implementation and analysis of test results. Students will learn how to develop questions to measure conceptual understanding and problem-solving skills in science, create instruments to assess scientific attitudes and science process skills, and apply criterion-referenced and norm-referenced assessments. Additionally, students will be trained to design higher-order thinking skills (HOTS) questions and evaluate instrument quality using both classical and modern approaches to determine validity and reliability with the aid of computer applications.
CLO	1. Explain the basic concepts of measurement and evaluation in science education and their importance in science education (PLO-4). 2. Understand and apply assessment principles and techniques appropriate to the characteristics of science learning (PLO-4). 3. Identifying and applying the taxonomy of cognitive, affective, and psychomotor domains in the development of science assessment instruments (PLO-4). 4. Formulating competency achievement indicators and developing questions that are in line with science learning objectives (PLO-4). 5. Developing test instruments, conducting assessments, and evaluating conceptual understanding and problem-solving skills in the context of science (PLO-4). 6. Developing assessment instruments for scientific attitudes and psychomotor skills in science learning (PLO-4). 7. Developing test items that accurately measure scientific process skills and higher-order thinking skills (HOTS) (PLO-4). 8. Applying criterion-referenced and norm-referenced assessments in the context of science assessment (PLO-4). 9. Analyzing the validity, reliability, and quality of test items using computer applications such as QUEST or other statistical software appropriately (PLO-4, PLO-5, PLO-6, PLO-8).

Code	SPI60205
Course Credit	2
Course Name	Microteaching in Science
Description	This course aims to equip prospective science teachers with basic teaching skills through microteaching activities. Activities include practicing the preparation of lesson plans or teaching modules, practicing basic teaching skills in a limited and integrated manner, and developing personal and social

	competencies. Microteaching is conducted through peer teaching designed as a simulation of real learning, as preparation for facing Educational Field Practice (PK) in schools. This course emphasizes the integration of pedagogical skills, mastery of science material, and professional attitudes of teachers in the context of 21st century learning.
CLO	1. Understand the basic principles and objectives of microteaching as teaching skills training (PLO-4). 2. Systematically develop a Lesson Plan (RPP) or teaching module along with supporting tools (PLO-4, PLO-5). 3. Practicing basic teaching skills in a limited (separate) manner in accordance with the characteristics of science learning (PLO-4, PLO-7). 4. Practicing basic teaching skills in an integrated and comprehensive manner through peer teaching activities (PLO-4, PLO-8). 5. Demonstrate personal competence as prospective science teachers who are integrity-driven, reflective, and responsible (PLO-1, PLO-2). 6. Demonstrating social competencies in building communication, teamwork, and empathy in the learning environment (PLO-1, PLO-2).

Code	MLK60601
Course Credit	6
Course Name	Educational Field Practice
Description	The Educational Field Practice (PK) course is a field experience designed to develop students' pedagogical, professional, personal, and social competencies as prospective educators. Through assistance or mentoring activities, students carry out the process of planning, implementing, and evaluating learning or training in formal and non-formal educational units, institutions, communities, or industries. Activities are conducted in real-world contexts, enabling students to integrate educational and academic knowledge in a contextual manner. The learning process spans one semester with a credit load of 6 Course Credit (170 minutes/week).
CLO	1. Demonstrate spiritual and social attitudes that reflect the values of religiosity, ethics, responsibility, tolerance, and politeness while carrying out educational practice (PLO-1, PLO-2). 2. Understand the philosophy and theoretical basis of educational practice implementation and its relevance in shaping the character of educators (PLO-4). 3. Analyzing learning or training needs objectively based on actual conditions in the field (PLO-8, PLO-7). 4. Designing learning/training/management work programs that are relevant to the field of science and the results of needs analysis (PLO-4, PLO-5, PLO-10). 5. Implement learning/training/management work programs using scientific, participatory, and contextual approaches (PLO-4, PLO-7). 6. Evaluate the implementation of the work program reflectively and compile a systematic report on the results of the practice (PLO-8, PLO-11).

Code	MLK60605
Course Credit	6
Course Name	Community Service Learning
Description	Community Service Learning (KKN) is a field-based course focused on community service designed to develop social, collaborative, leadership, and practical application skills in real-life contexts. Through this program, students engage directly with communities to identify local potential, address

	challenges, and design and implement participatory and sustainable community empowerment programs. Activities include education, mentoring, and advocacy based on local wisdom values and sustainability principles, as a tangible contribution by students to enhance community capacity and well-being.
CLO	1. Demonstrating care, empathy, and social sensitivity in building relationships with the community and environment (PLO-1, PLO-2). 2. Collaborating effectively in multidisciplinary teams and valuing social and cultural diversity (PLO-2, PLO-7). 3. Designing, implementing, and evaluating work programs based on local potential and community needs in a participatory manner (PLO-8, PLO-9). 4. Adapting the knowledge and skills acquired during lectures to solve problems in the community (PLO-7, PLO-10). 5. Creating innovative and contextual solutions in addressing social problems through educational and empowerment approaches (PLO-9, PLO-10). 6. Demonstrate leadership, responsibility, and professional ethics during the implementation of the Community Service Program (PLO-2, PLO-11). 7. Communicating effectively and ethically in social and community environments while upholding local wisdom values (PLO-1, PLO-2).

Academic Development Courses

Code	MKK60301
Course Credit	3
Course Name	Research Methodology
Description	This course examines the basic concepts of research in educational research (the meaning of science, knowledge, and science, methods of acquiring knowledge, the meaning, purpose, benefits, characteristics, and functions of research), types of research, research problems and variables, theoretical foundations and the usefulness of theory in research, conceptual frameworks, and hypotheses. Additionally, it discusses research design (basic concepts and types of research design), population and sample (definition of population and sample, sample size, how to take samples), data collection (types of research data, definition and limitations of instruments, types of instruments, types of measurement scales, research instruments, how to develop research instruments, validity and reliability of research instruments), and research data analysis techniques. This course is expected to equip students with basic knowledge, understanding, and skills regarding research methodology, particularly in the field of science education, as well as responsible behavior in handling their own lecture assignments and group lecture assignments.
CLO	1. Explain the basic research paradigms and concepts, including philosophy, the nature of science, scientific methods, and their role in science education (PLO-6). 2. Identify and differentiate types of research approaches, including qualitative, quantitative, and mixed methods in the context of science learning (PLO-6). 3. Explaining research variables and applying appropriate sampling techniques for research in science education (PLO-6, PLO-8). 4. Analyzing research design characteristics, including surveys and experiments, and their relevance to science learning research (PLO-6). 5. Analyzing the characteristics of research and development (R&D) in the development of science education learning tools (PLO-6). 6. Analyzing the stages in the preparation of research instruments, particularly valid and reliable data collection instruments using computer technology (PLO-5, PLO-6). 7. Applying research data analysis techniques to answer research questions in the context of science education (PLO-5, PLO-6).

	8. Systematically developing science education research proposals in accordance with academic principles and professional research ethics (PLO-2, PLO-6).

Code	MKK60801
Course Credit	8
Course Name	Final Project
Description	This course equips students to prepare scientific papers in the form of final projects based on independent research in the field of science education. Students apply educational research methodologies systematically and in accordance with scientific principles, utilizing the latest knowledge , and technology. In its implementation, students are expected to demonstrate critical, analytical, and creative thinking skills, as well as uphold academic ethics and professionalism. The process of preparing the final project includes problem identification, literature review, instrument development, data collection and analysis, conclusion drawing, and the preparation of a scientific report and its presentation both orally and in writing.
CLO	1. Formulating science education research problems based on contextual phenomena in the field (PLO-3, PLO-6, PLO7). 2. Compiling relevant and up-to-date literature reviews as a basis for research (PLO-6, PLO-2). 3. Developing a research proposal with appropriate scientific systematics and methods (PLO-6, PLO-7, PLO-8). 4. Systematically develop research instruments (PLO-2, PLO-5, PLO-6, PLO-7). 5. Conducting research by applying safety and academic ethics principles (PLO-2, PLO-6, PLO-8). 6. Analyzing and interpreting research data accurately and objectively (PLO-3, PLO-6, PLO-7). 7. Writing a thesis report that complies with the rules of scientific writing (PLO-6, PLO-11). 8. Presenting research results professionally and communicatively (PLO-11, PLO-2). 9. Demonstrate a responsible, independent, critical, and ethical attitude in the thesis writing process (PLO-1, PLO-2, PLO-6).

Foundational Courses for the Program

Code	SPI60206
Credit	2
Course Name	Mathematics for Science
Description	This course covers basic mathematical concepts that support understanding and application in the field of Natural Sciences (IPA). The material covered includes real number systems and arithmetic operations, exponential forms, roots, scientific notation, mathematical symbols, and logarithms. Students also learn linear and quadratic equations, quadratic functions, and inequalities. Additionally, basic concepts of geometry and trigonometry are discussed, along with arithmetic sequences, geometric sequences, and sigma notation. In the final section, students are introduced to basic calculus, including derivatives (differentials) and integrals, which are used to analyze changes and areas/volumes in the context of scientific phenomena.
CLO	1. Understand and apply the concepts of real number systems and perform basic calculations accurately in the context of solving scientific problems (PLO-3). 2. Using exponents, roots, scientific notation, mathematical symbols, and

	logarithms in quantitative modeling and calculations (PLO-3). 3. Formulating and solving linear equations, quadratic equations, quadratic functions, and inequalities, and interpreting the results in the context of science (PLO-3). 4. Applying basic principles of geometry and trigonometry to solve spatial problems and calculations in science (PLO-3). 5. Understand and apply arithmetic series, geometric series, and sigma notation in calculations and patterns in science (PLO-3). 6. Understand and apply basic calculus concepts (differential and integral) to analyze changes, rates, and measurements of area/volume in scientific phenomena (PLO-3).

Code	SPI60301
Course Credit	3
Course Name	Basic Science
Description	The Basic Science course aims to develop students' competence in understanding basic scientific concepts, the nature of science, and how scientists work through the scientific method. Students will be able to analyze the characteristics of natural sciences as a process and product, as well as the scientific attitude that must be possessed in a scientific approach. In addition, this course also discusses the integration of concepts in science (biology, chemistry, physics) and relates the relationship between science and technology in the context of society. This course also introduces science literacy relevant to international standards such as OECD and NSTA, as a basis for exploring and applying science in the context of daily life and learning.
CLO	1. Explaining the basic concepts and nature of science as the foundation of science education (PLO-3, PLO-4). 2. Analyzing the characteristics of science as a process and product in the context of scientific development and learning (PLO-3, PLO-7). 3. Explaining the stages of the scientific method and how scientists work in constructing scientific knowledge (PLO-3, PLO-6). 4. Applying the scientific method to explain natural phenomena systematically (PLO-6, PLO-8). 5. Relate biology, physics, and chemistry concepts as part of the integration of science in explaining natural phenomena (PLO-3). 6. Analyzing the relationship between science, technology, and society in the context of everyday life (PLO-5, PLO-4). 7. Demonstrate scientific, critical, and objective attitudes in understanding and solving science-based project problems (PLO-2, PLO-4). 8. Interpreting the importance of science literacy based on international standards (e.g., OECD, NSTA) in the development of science learning and understanding (PLO-3, PLO-5).

Code	SPI60302
Course Credit	3
Course Name	General Biology I
Description	This course discusses the nature of biology as a science (in terms of its objects, phenomena, and issues, as well as its scientific methods) and the themes (types) of biological issues according to the BSCS *(Biology Science Curriculum Standard)*, including: Life (a *view of Life)*, Chemistry of Life, Structure and organization of organisms, Diversity of organisms, Classification of organisms, Ecosystems, diversity, regulation and homeostasis, theories of the origin of life and evolution, and technology in biology, as well as developing personality (attitude), scientific knowledge, and skills (performance) in scientific work/practice to explore these topics in an activity using observation and

	experimentation methods, the the results are analyzed, interpreted, and presented both orally and in writing.
CLO	1. Understanding the nature of biology as a science (examined from the perspective of objects, phenomena, and issues as well as its scientific methods) (PLO-3). 2. Identifying the characteristics of life (PLO-3). 3. Mastering various biological issues according to BSCS *(Biology Science Curriculum Standard*) including structure and function, interactions between organisms and the environment, diversity, behavior, regulation & homeostasis, evolution (PLO-3). 4. Develop personality (attitude), scientific knowledge, and skills (performance) in scientific work/practice to explore them in an activity using experimental or observational methods, analyzing, interpreting, and presenting orally and in writing (PLO-2, PLO- 10).

Code	SPI60303
Course Credit	3
Course Name	General Chemistry I
Description	This course aims to develop competencies in understanding the concepts of substances and materials; atoms, molecules, and ions; the periodic table of elements; chemical bonding; stoichiometry; colligative solutions, acids and bases; chemical equilibrium; reaction kinetics; thermochemistry and thermodynamics.
CLO	1. Describe the basic concepts of chemistry regarding substances and matter and their relationship to everyday life (PLO 3). 2. Connect electron configuration with the properties of elements in the periodic table of elements, so as to be able to identify the potential for chemical bonding as a requirement in the formation of a compound. (PLO 3 and PLO 8). 3. Solve problems related to stoichiometry associated with chemical reactions that commonly occur in everyday life (PLO 3 and PLO 7). 4. Explaining the basic principles of thermochemistry and thermodynamics and applying them in solving science problems using a mathematical approach (PLO7 and PLO 8). 5. Explain the concepts of colligative properties of solutions and acid-base solutions and their applications in everyday life (PLO 3, PLO 7, and PLO 8). 6. Analyze chemical equilibrium processes so that chemical reactions can produce maximum products, which are useful in industry and everyday life, and reaction kinetics in life (PLO 3, PLO7, and PLO 8). 7. Explain the principles of chemical kinetics and relate the factors that influence them so that optimal reaction conditions can be achieved, which are useful in everyday life, including in the fields of health, agriculture, and technology (PLO 3, PLO 7, and PLO 8).

Code	SPI60304
Course Credit	3
Course Name	Basic Physics I
Description	This course covers basic physics concepts and their applications in everyday life and science education. Topics include vector analysis, mechanics (motion, force, work, energy, momentum), fluids, basic thermodynamics, vibrations, waves, and sound. Lectures are conducted in an integrated manner through a combination of theory and practical work to develop conceptual understanding, experimental skills, and students' analytical and problem-

	solving abilities based on a scientific approach. Students are trained to relate physics concepts to natural phenomena and technology in a contextual manner and to compile scientific reports on the results of practical work.
CLO	1. Explain and apply mechanics concepts to analyze various phenomena in daily life and the surrounding environment (PLO-3, PLO-4, PLO-7). 2. Explain and apply the concepts of heat and basic thermodynamics in various physical phenomena and contextual life (PLO-3, PLO-7). 3. Explain and apply the concepts of vibration, waves, and sound and their implications in natural systems and simple technology (PLO-3, PLO-9). 4. Designing and conducting simple experiments on topics in mechanics, heat, and sound-waves, and presenting the results in the form of a scientific report (PLO-5, PLO-7, PLO-11).

Code	SPI60207
Course Credit	2
Course Name	Measuring Instruments and Measurement Methods in Science
Description	This course covers the basic concepts and measurement methods required in science experiments. The material covered includes the definition of science experiments, quantities and units, dimensional analysis, and the concepts of measurement and measurement standards. Students will be introduced to various types of measuring instruments commonly used in science experiments, as well as their principles and techniques of use, including measurements using *capture* techniques (images and videos) that can be analyzed using computer applications. The material also discusses errors and their sources, writing measurement results, single and repeated measurements, error propagation analysis, discrepancies, and data rejection methods. Students are also trained in graphical analysis and linear regression, as well as digital processing of experimental data using software (e.g., Microsoft Excel, Tracker, ImageJ, or other applications).
CLO	1. Explain the basic concepts of experiments in science, including quantities, units, and dimensional analysis in the context of scientific measurement (PLO-3). 2. Understand the basic principles of measurement and measurement standards, as well as identify and use various conventional and digital measuring instruments in science experiments (PLO-3). 3. Explaining the types of errors and their sources, as well as applying techniques for reporting measurement results systematically, precisely, and accurately (PLO-3). 4. Distinguishing between single and repeated measurements, and performing error propagation analysis, discrepancy analysis, and data rejection in measurement result processing (PLO-3). 5. Performing graphical analysis and linear regression to identify patterns and relationships between variables in science measurement results. 6. Performing measurements based on *capture* techniques (images and videos) and interpreting the results using supporting software (PLO-5). 7. Using computer applications (such as Microsoft Excel, Tracker, or similar software) to process, analyze, and present experimental data effectively (PLO-5). 8. Using measuring instruments and measurement methods appropriately and compiling measurement reports objectively, systematically, accurately, and in accordance with scientific writing rules (PLO-2, PLO-5).

Code	SPI60305
Course Credit	3

Course Name	General Biology II
Description	This course discusses and develops competencies in understanding Cytology (definition & theory of cells, as well as their potential: cell types & structures; cell growth & cycle), Microbiology (Bacteria & Fungi), and Genetics (Mendel's inheritance patterns & sex genetics) as well as developing personality (attitude), scientific knowledge, and skills (performance) in work/practice to deepen understanding through activities using observation and experimentation methods, with results analyzed, interpreted, and presented both orally and in writing.
CLO	1. Understanding Cytology (Concepts & theories of cells, as well as their potential: Types of cells & cell structures (PLO-3). 2. Understanding cell growth and cycle (PLO-3). 3. Understanding Microbiology (Bacteria & Fungi) (PLO-3). 4. Understanding Genetics (Mendel's Laws of Inheritance and Sex Genetics) (PLO-3). 5. Developing personality (attitude), scientific knowledge, and skills (performance) in work/practice to deepen understanding through activities using observation and experimentation, analysis, interpretation, and presentation both orally and in writing (PLO-2, PLO-10).

Code	SPI60306
Course Credit	3
Course Name	General Chemistry II
Description	This course develops students' competence in understanding chemical concepts in everyday life (organic and biochemical compounds), electrical conductivity, redox and electrochemistry, colloids, solubility and solubility product, nuclear chemistry and radioactivity, and coordination chemistry.
CLO	1. Explain the concepts of organic chemistry and its derivatives (carbohydrates, proteins, fats) and their applications in daily life (PLO3). 2. Explain the basic concepts of electrical conductivity, redox, and electrochemistry and apply them in everyday life and industry (PLO 3, PLO 7, and PLO 8). 3. Explains the concepts of colloids and their applications in everyday life and industry (PLO 3, PLO 7, and PLO 8). 4. Relate the concepts of solutions and solubility products and their applications in daily life and industry (PLO 3 and PLO 8). 5. Explain the concept of nuclear chemistry of radioactivity and its applications in everyday life and industry (PLO 3 and PLO 8). 6. Understand the concept of coordination compounds and their applications in daily life (PLO 3 and PLO 8).

Code	SPI60307
Course Credit	3
Course Name	Basic Physics II
Description	This course provides a basic understanding of the concepts of physics that form the basis for explaining various natural phenomena, with an emphasis on electricity, magnetism, optics, and modern physics. Students will learn electrical concepts covering static and dynamic electricity, including electrical laws, electric fields and potentials, and electromagnetic induction phenomena in magnetism. In the study of optics, the properties of light, image formation, interference, diffraction, and polarization are discussed. Modern physics is introduced as a development of classical physics to explain phenomena on a

	microscopic scale and at high speeds that cannot be explained by Newton's laws. In this section, students will learn key concepts such as the special theory of relativity, wave-particle duality, the photoelectric effect, atomic structure models, and the basics of nuclear physics.
CLO	1. Explains the concepts and basic laws of static electricity, including Coulomb's Law, electric fields, electric potential, and electric potential energy, as well as the concepts of capacitors and capacitance in various configurations (PLO-3). 2. Analyzing the concepts of dynamic electricity, including AC and DC electric currents, Ohm's Law, Kirchhoff's Law, and the calculation of electrical energy in electrical circuits (PLO-3). 3. Explain the basic principles of magnetism, including magnetic forces and fields, covering Biot–Savart's Law and Ampère's Law, electromagnetic induction, covering Faraday's Law and Lenz's Law, as well as the working principles of devices such as generators, transformers, and dynamos and their application in everyday life and technology (PLO-3, PLO-7). 4. Understand and analyze the properties of light and optical phenomena, both geometric optics and physical optics, such as image formation in lenses and mirrors, interference, diffraction, and polarization (PLO-3). 5. Distinguishing the characteristics of classical physics and modern physics, and explaining the background of the emergence of modern physics (PLO-3). 6. Explaining the main concepts in modern physics, such as the special theory of relativity, wave-particle duality, the photoelectric effect, atomic structure models, and nuclear physics (PLO-3). 7. Apply physics concepts to natural phenomena and technology, and demonstrate the interrelationship between electricity, magnetism, optics, and modern physics concepts in real-life contexts (PLO-3). 8. Designing experiments in basic physics on topics of electricity, magnetism, optics, and an introduction to modern physics, and being able to communicate the results in the form of a report (PLO-8, PLO 11).

Code	SPI60308
Course Credit	3
Course Name	Information and Communication Technology in Science Education
Description	This course develops students' competencies in utilizing locally-based digital technology for sustainable innovation in science education. Students will integrate science concepts, pedagogy, and ICT through the development of interactive learning media, data-based analysis of scientific phenomena, and the presentation of scientific information relevant to both local and global contexts. Learning emphasizes the STEAM (Science, Technology, Engineering, Arts, Mathematics) approach with the utilization of local resources and wisdom.
CLO	1. Analyze the working principles of ICT systems (hardware, software, networks) and their application in daily life and science learning (Related to PLO-3, PLO-5, PLO-7). 2. Evaluate AI (Artificial Intelligence)-based learning technologies and their potential integration with science materials based on the local context (Related to PLO-5, PLO-7, PLO-9). 3. Develop collaborative digital teaching materials using Google for Education (Docs, Spreadsheet, Presentation) with the integration of scientific references (Mendeley) and local content (Related to PLO-4, PLO-5, PLO-10). 4. Designing a hybrid learning system through the use of a Learning

	Management System (LMS) by adapting to the needs of schools in various regions (Related to PLO-4, PLO-7, PLO-8). 5. Creating interactive digital assessment instruments (Online Assessment System) that consider aspects of technological access equality in regions (Related to PLO-4, PLO-5, PLO-8). 6. Producing immersive learning media (AR/VR) and 3D modeling for the visualization of science concepts related to local potential (e.g., regional ecosystems, geological phenomena) (Related to PLO-3, PLO-9, PLO-11). 7. Disseminating the results of scientific phenomenon analysis using PhET Simulations through worksheets based on local issues (Related to PLO-6, PLO-9, PLO-11). 8. Creating science communication products (digital posters, infographics) using Canva that integrate local wisdom values and scientific principles (Related to PLO-2, PLO-10, PLO-11).

Code	SPI60309
Credit	3
Course Name	School Science Studies I
Description	The School Science Studies I course aims to develop students' competence in comprehensively understanding the science concepts taught in grade VII in accordance with the junior high school/Islamic junior secondary school curriculum. Students are expected to master pedagogical approaches in conveying science concepts and develop scientific attitudes and investigative skills in line with the characteristics of science learning at that level. This course also discusses strategies for integrating biology, physics, and chemistry concepts into contextual and meaningful learning for students. Students are guided to analyze various subject matters such as the nature of science, measurement, and scientific methods; the concept of substances and their changes; temperature, heat, and expansion; motion and force; classification of living things; as well as ecology and biodiversity. Each subject is integrated with the development of learning designs that are in line with the scientific approach and the learning needs of junior high school students. The approach used also encourages the development of critical thinking, problem-solving, and science literacy skills.
CLO	1. Explaining the nature of science, measurement, and the scientific method in the context of science learning in seventh grade junior high school. (PLO-3, PLO-4) 2. Analyzing the concepts of substances and their changes and designing appropriate learning for students. (PLO-3, PLO-4). 3. Explaining the concepts of temperature, heat, and expansion, as well as effective teaching methods for students. (PLO-3, PLO-4). 4. Analyzing the concepts of motion and force and appropriate teaching methods. (PLO-3, PLO-4). 5. Analyzing the classification of living things and designing appropriate learning. (PLO-3, PLO-4). 6. Analyzing ecology and biodiversity and designing learning activities that support student understanding. (PLO-3, PLO-4).

Code	SPI60208
Course Credit	2
Course Name	Science Education Strategy and Management
Description	This course equips students with the ability to design science learning strategies and manage learning comprehensively and effectively. The material covers task analysis (curriculum analysis and material analysis), the preparation of curriculum-based learning tools, learning scenario planning,

	media selection and use, classroom management, and science learning evaluation. This course emphasizes the integration of science and technology, as well as the development of creative, innovative, sustainable, and globally competitive learning. Students are guided to produce applied science learning designs in real-world contexts and to manage learning independently and collaboratively.
CLO	1. Explaining concepts and theories of science learning management, including planning, implementation, and evaluation (PLO-4, PLO-7). 2. Analyzing effective and efficient approaches, strategies, methods, techniques, and tactics for science learning in various classroom conditions s (PLO-4, PLO-5). 3. Designing science learning tools based on the curriculum, including CP, TP, and ATP that are appropriate to the context (PLO-4). 4. Developing effective classroom management plans to support conducive and sustainable science learning (PLO-4, PLO-5). 5. Implementing information technology in science learning to support creative and innovative learning strategies and management (PLO-5, PLO-7). 6. Assessing and evaluating science learning outcomes based on relevant criteria to improve and enhance learning (PLO-6, PLO-4). 7. Demonstrate scientific, creative, innovative, and responsive attitudes in designing and managing science learning in the form of science learning practice simulations (PLO-2, PLO-4).

Code	SPI60310
Course Credit	3
Course Name	Earth and Space Science
Description	This course integrates Earth and space concepts using a STEAM (Science, Technology, Engineering, Arts, Mathematics) approach based on local potential to develop the competencies of prospective science teachers in understanding and teaching the dynamics of Earth and the universe. Learning emphasizes the analysis of Earth and space phenomena specific to Indonesia, the use of digital technology, and the development of creative solutions for education and disaster mitigation relevant to both local and global contexts.
CLO	1. Analyze the mechanisms of Earth's structural changes and their relationship to the potential for geological disasters in Indonesia (Related to PLO-3, PLO-7, PLO-9). 2. Evaluating hydrosphere processes (groundwater, ocean currents) and designing water resource conservation strategies based on local wisdom (Related to PLO-3, PLO-8, PLO-10). 3. Investigating Indonesian atmospheric phenomena (monsoons, ENSO) through satellite data analysis and simple tools (Related to PLO-3, PLO-5, PLO-7). 4. Designing models for mitigating terrestrial disasters (earthquakes, tsunamis) that integrate digital technology and local wisdom (Related to PLO-4, PLO-9, PLO-11). 5. Analyzing the characteristics of Earth in the solar system through virtual modeling (Stellarium/Celestia) with a local observation context (Related to PLO-3, PLO-5, PLO-7). 6. Classify celestial objects based on their physical characteristics and their relationship to astronomical phenomena in Indonesia (Related to PLO-3, PLO-6, PLO-9). 7. Applying Kepler's Laws and Newton's Law of Gravity to predict astronomical phenomena (eclipses, tides) in the Indonesian region (Related to PLO-3, PLO-7, PLO-8). 8. Developing interactive learning media about stars that integrate Indonesian astronomy mythology (Related to PLO-2, PLO-9, PLO-11).

Code	SPI60209
Course Credit	2
Course Name	Environmental Science
Description	This course develops students' competence in understanding the environment so that they can become "environmentally literate" (*scientific literacy* in the field of Environmental Science) by examining environmental concepts including ecology as the basis of environmental science, biotic and abiotic environments, ecosystems, interactions between ecosystem components, human relationships with the environment, environmental principles, natural resources, environmental pollution, environmental ethics, and Environmental Impact Assessment (EIA) so that students can participate in community life and make appropriate decisions related to Environmental Science and the sustainability of environmental systems.
CLO	1. Describe the scope of ecology, ecological concepts, and ecological principles (PLO-3). 2. Understand ecosystems and their types (PLO-3). 3. Analyze interactions between ecosystem components (PLO-3). 4. Describe and draw conclusions about local issues concerning ecosystems (PLO-3). 5. Explaining environmental principles and environmental ethics (PLO-3). 6. Identify various environmental issues and problems such as water, air, and soil pollution (PLO-3, PLO-7). 7. Formulating solutions to address water, air, and soil pollution (PLO-7, PLO-8). 8. Explaining and understanding Environmental Impact Assessment (EIA) (PLO-3, PLO-8).

Code	SPI60210
Course Credit	2
Course Name	Chemistry in Life
Description	This course develops competencies in understanding the application of chemistry in everyday life, covering the fields of industry, agriculture, health, food, and natural materials.
CLO	1. Understand the general principles of applied chemistry in everyday life (PLO-3). 2. Analyzing industrial process technology and industrial waste and its management (PLO-3, PLO-7). 3. Understanding the application of chemistry in agriculture, particularly in relation to pesticides and soil (PLO-3, PLO-10). 4. Analyzing the application of chemistry in the field of health, particularly in medicines and radiochemical equipment (PLO-3, PLO-7). 5. Identifying concepts of food analysis and preservation in food processing (PLO-3, PLO-10). 6. Explaining the chemical utilization of natural materials and their isolation processes (PLO-3, PLO-9).

Code	SPI60311
Course Credit	3
Course Name	Science Laboratory Management and Techniques
Description	This course develops competencies in the aspects of science laboratory management and design, which include 1) administration & inventory of

	equipment and materials, 2) arrangement & handling of equipment and materials, 3) organizing laboratory personnel/organizational structure, 4) laboratory safety, 5) laboratory building and layout design, and 6) design of tools and materials for laboratory work and budgeting; develops aspects of science laboratory technical competencies, which include techniques for using science practicum equipment (science kits, triple beam balances, hygrometers, microscopes, multimeters, etc.), techniques for preparing and making preserved specimens (wet and dry), techniques for making and diluting chemical solutions, and developing personality (attitude), scientific knowledge, and skills (performance) in scientific work/practice to deepen understanding through activities using observation and experimentation methods, the results of which are analyzed and interpreted, both verbally and in writing.
CLO	1. Mastering the principles and application of laboratory management, including administration and inventory of tools and materials, arrangement and handling of tools and materials, and organizing laboratory personnel/organizational structure (PLO-5, PLO-7). 2. Understand the design of buildings and laboratory spaces, and be able to design tools and materials for laboratory work and their budgeting (PLO-7, PLO-10). 3. List and explain the use of science practical tools and materials (PLO-3). 4. Operate the main science laboratory equipment (Science Kit, triple beam balance, hygrometer, microscope, multimeter, etc.) (PLO-8, PLO-7). 5. Mastering specimen preparation and preservation techniques (wet and dry) as well as chemical solution preparation and dilution techniques (PLO-8, PLO-3). 6. Understanding and applying safety and security protocols in science laboratories (PLO-8, PLO-2).

Code	SPI60312
Course Credit	3
Course Name	School Science Studies II
Description	School Science Studies II course aims to develop students' competence in comprehensively mastering Grade 8 science concepts in accordance with the junior high school/Islamic junior secondary school curriculum. Students are equipped with the ability to analyze and design learning for various core topics in science, such as the concepts of cells and microscopes, the structure and function of living things, work, energy, and simple machines, as well as vibrations, waves, and light. In addition, students also learn about the concepts of elements, compounds, and mixtures, as well as the structure of the earth and its development, accompanied by a pedagogical approach to teaching the material in a contextual and meaningful way. This course also emphasizes the importance of developing students' scientific personalities, including critical thinking, curiosity, and skills in in-depth science investigation activities oriented towards science literacy. Through an inquiry-based and problem-based learning approach, students are expected to be able to design active and collaborative learning activities in accordance with the characteristics of junior high school students.
CLO	1. Analyzing cell and microscope concepts and designing appropriate learning activities for students (PLO-3, PLO-4). 2. Analyzing the structure and function of living organisms and designing effective teaching strategies (PLO-3, PLO-4). 3. Analyzing the concepts of work, energy, and simple machines and designing contextual learning (PLO-3, PLO-4) 4. Analyzing the concepts of vibration, waves, and light and designing learning that is appropriate for student characteristics (PLO-3, PLO-4). 5. Analyzing the concepts of elements, compounds, and mixtures and designing effective and meaningful learning (PLO-3, PLO-4).

	6. Analyzing the structure of the Earth and its development and designing learning that is appropriate for students (PLO-3, PLO-4).

Code	SPI60313
Course Credit	3
Course Name	Plant Structure and Function
Description	This course is related to its laboratory component, developing competencies in the Concept of Plant Structure; which includes Morphology and Anatomy, and their relationship with Plant Function; covering Water Transport Processes in Plants, Nutrients & Their Absorption Processes, Photosynthesis & Photosynthate Translocation Processes, Respiration Processes, and Plant Growth & Development Processes; developed through case study-based learning activities and experimental projects.
CLO	1. Analyzing the morphological and anatomical characteristics of plant vegetative organs and their modifications (PLO-3). 2. Analyzing the morphological and anatomical characteristics of plant generative organs and their modifications (PLO-3). 3. Relate plant structures to their physiological functions (PLO-3). 4. Explaining the basic mechanisms in the processes of absorption, transport, and loss of water, the absorption of nutrients needed by plants, and the symptoms of their deficiency (PLO-3). 5. Explaining the basic mechanisms of physiological processes in plants (photosynthetic translocation, respiration, photosynthesis) (PLO-3). 6. Explaining vegetative and generative growth and development, as well as the changes formed in each plant organ (PLO-3).

Code	SPI602211
Course Credit	2
Course Name	Waves and Optics
Description	This course equips prospective science teachers with a deep understanding of wave concepts, light, and optics, as well as their applications in daily life, technology, and the local environment. Through a scientific inquiry-based approach, students will study mechanical waves, sound waves, the properties of light, reflection, refraction, optical instruments, and the use of digital technology for simulations and experiments.
CLO	1. Explain the basic principles of waves, geometric optics, and optical physics with examples from local potential (Related to PLO-3, PLO-7, PLO-9). 2. Analyzing the relationship between wave theory and optics with modern technology applications and local solutions (Related to PLO-3, PLO-5, PLO-10). 3. Designing wave and optics experiments based on local materials and digital technology (Related to PLO-7, PLO-8, PLO-9). 4. Developing creative learning media relevant to the junior high school/ Islamic junior secondary school science curriculum (Related to PLO-4, PLO-5, PLO-11). 5. Exploring local wisdom related to waves and optics as a learning context (Related to PLO-1, PLO-2, PLO-9).

Code	SPI60212
Course Credit	2

Course Name	Biotechnology
Description	This course develops competencies regarding the development of technology based on basic biological concepts (totipotency, dedifferentiation, and recombinant DNA) in various fields, including agriculture (tissue culture techniques, cloning, and transgenic organisms), the food industry, health, environmental remediation, Bioenergy Feedstock Production, and Investigation & Diagnosis (DNA Testing & Biochip-Biosensors). The course is conducted through active student participation, case-based learning, and project-based learning.
CLO	1. Analyzing the concepts, procedures, types, purposes, benefits, and s of Tissue Culture Techniques (PLO-2&3). 2. Analyze the concepts, methods, and procedures of cloning using SNCT techniques, as well as the advantages and disadvantages of cloning applications (PLO-2&3). 3. Analyze the basic stages of recombinant DNA techniques (genetic engineering), & the various tools required, and be able to interpret the recombinant DNA technology sketch by Stanley Cohen and Herbert Boyer (1973) (PLO-2&3). 4. Analyze the application of genetic engineering in the creation/production of transgenic organisms, both in transgenic plants and transgenic animals. 5. Analyze the application of genetic engineering in the production of several food ingredients (citric acid, vitamin C, and recombinant chymosin), and in the field of health (insulin and recombinant vaccines) (PLO-2&3). 6. Analyzing the application of genetic engineering in the provision of bioenergy materials and environmental remediation materials (PLO-2 & 3). 7. Analyzing DNA fingerprinting techniques and biochip biosensors (PLO-2&3). 8. Producing food through fermentation processes (tempeh, tape, cheese, brem, nata de coco, yogurt, etc.) (PLO-2,3&9).

Code	SPI60213
Course Credit	2
Course Name	Local Wisdom in Science Education
Description	Developing students' competence in mastering the integration of science fields sourced from local excellence (culture, industry, agriculture, and other potential sources of regional income) and having the potential as a source of science learning in the development of study objects, learning resources, and environmental laboratories, thereby impacting the growth of science literacy and students' attitudes of concern and their integration into science learning.
CLO	1. Understanding the basic concepts of integrated science in local potential (PLO-4, PLO 9). 2. Analyzing various forms of local wisdom as representations of scientific knowledge (PLO-3, PLO-4, PLO-9). 3. Analyzing science concepts in local potential, indigenous knowledge, and ethnoscience in everyday life (PLO-3, PLO-7, PLO-9). 4. Designing science learning that accommodates local wisdom values (PLO-4, PLO 9). 5. Developing teaching materials and learning media based on local wisdom (PLO-4, PLO-9).

Code	SPI60314
Course Credit	3

Course Name	Animal Structure and Function
Description	This course develops students' competence in analyzing the morphological structure of animals (including the phyla Porifera, Coelenterata, Platyhelminthes, Nemathelminthes, Annelida, Mollusca, Arthropoda, Echinodermata, and Chordata) and its relationship to function (specifically for Chordata, analysis is based on the human organ system); conducted through study-discussion activities, and projects (exploration, observation, and practical work).
CLO	1. Analyzing the morphological structure of invertebrate animals (covering the phyla Porifera, Coelenterata, Platyhelminthes, Nemathelminthes, Annelida, Mollusca, Arthropoda, Echinodermata, and their relationship to their functions (PLO-3). 2. Conducting exploration and observation of invertebrate animals to identify their morphological structures and functions. 3. Analyzing the morphological structure of the phylum Vertebrata and its relationship to its function (specifically Chordata, analysis based on the human organ system) (PLO-3). 4. Conducting exploration and observation of vertebrate animal specimens to identify their morphological structures and functions (PLO-2, PLO 10).

Code	SPI60214
Course Credit	2
Course Name	Applied Science
Description	Applied Science is a course that studies the application of natural sciences (IPA) to solve practical problems. The learning material is dynamic and evolves in line with technological advances. The application of natural sciences referred to includes the production of organic fertilizers, rockets, generators, solar panels, switches, and bioenergy.
CLO	1. Mastering the basic principles of creating electricity-based products through discussions and presentations (PLO-3). 2. Ability to create and implement electricity-based natural science ideas through experimental activities (PLO-2, PLO-3). 3. Able to possess product manufacturing skills through the fermentation process (PLO-7). 4. Able to create innovative product ideas based on local potential through project activities (PLO-2, PLO-3).

Code	SPI60215
Course Credit	2
Course Name	STEM
Description	This course explores the fundamental concepts and philosophy of integrated STEM learning in science education, analyzes the integration of science, technology, engineering, and mathematics in science curriculum, designs innovative and context-based STEM activities and lesson plans, and collaborates to develop prototypes or innovative and environmentally friendly solutions based on STEM (through *creativity, mechatronics,* and *capstone projects)* to address learning or environmental issues by leveraging local potential to support globally-oriented science competencies.
CLO	1. Understanding the basic concepts and philosophy of integrated STEM learning and its relevance to science education (PLO-3, PLO-4). 2. Analyzing the potential for integration between science, technology, engineering, and mathematics in the context of science subject matter

	(PLO-3, PLO-5). 3. Designing creative, innovative science learning activities based on STEM that utilize technology and local potential (PLO-9). 4. Developing science learning implementation plans (RPP) that integrate STEM principles and are problem-solving oriented (PLO-9). 5. Produce simple prototypes or innovative STEM-based solutions that utilize local potential to address problems in science education or the surrounding environment (PLO-9, PLO-10). 6. Effectively communicating STEM-based prototypes or innovative solutions (PLO-11).

Code	SPI60216
Course Credit	2
Course Name	Electricity and Magnetism
Description	This course is designed to equip students with an understanding and skills in applying basic concepts of electricity and magnetism in everyday life and science education. The material covers simple electrical circuits, Ohm's law, series and parallel circuits, terminal voltage, conductor resistance, Wheatstone bridges, batteries, capacitors and their circuits, electromagnetic induction, and alternating current (AC) circuits. Learning is conducted in an integrated manner between theory and practicum through a scientific and problem-solving approach to develop students' critical thinking skills, experimental skills, and the relevance of electrical-magnetic applications in life and education.
CLO	1. explain basic electrical concepts and phenomena related to current, voltage, resistance, and electrical power in various contexts (PLO-3, PLO-4). 2. Explain the concepts of magnetism and the interaction of magnetic fields with materials and electric currents in simple systems (PLO-3, PLO-4). 3. Explain electromagnetic principles and their application in various phenomena and technological devices in everyday life (PLO-3, PLO-5, PLO-7). 4. Using and interpreting measurement results from various electrical and magnetic measuring instruments in static and dynamic electrical circuits (PLO-5, PLO-7).

Code	SPI60217
Course Credit	2
Course Name	Videography
Description	This course develops the competencies of prospective science teachers in creating innovative, interactive, and contextual video-based learning media by integrating pedagogical principles, science content, and the use of digital technology based on local potential. Students will master the process of educational video production, from planning scientific content, filming in the surrounding environment, to creative publication that supports community science literacy.
CLO	1. Analyzing the philosophy of science video learning media using a STEAM approach based on local context (Related to PLO-4, PLO-5, PLO-9). 2. Developing a classification of science learning videos (tutorials, virtual experiments, science documentaries) that highlight local natural phenomena (Related to PLO-3, PLO-9, PLO-11). 3. Creating science video scripts with the integration of local wisdom

	(folklore, scientific traditions of the community, natural potential of the region) (Related to PLO-1, PLO-4, PLO-10). 4. Producing screen recording videos of virtual science experiments using PhET/GeoGebra with multilingual narration (Related to PLO-5, PLO-7, PLO-11). 5. Designing low-cost science experiment videos using local equipment and smartphone cameras with basic cinematography techniques (Related to PLO-3, PLO-7, PLO-9). 6. Applying outdoor filming techniques for local earth/astronomical phenomena with simple gimbal stabilization (Related to PLO-3, PLO-5, PLO-8). 7. Developing interactive videos with augmented reality markers based on local culture (e.g., AR of endemic flora in videos) (Related to PLO-5, PLO-9, PLO-10).

Code	SPI60315
Course Credit	3
Course Name	School Science Studies III
Description	School Science Studies III course aims to develop students' competence in comprehensively mastering ninth-grade science concepts in accordance with the junior high school/Islamic junior secondary school curriculum. Students are equipped with the ability to analyze and teach various important topics in science, such as the growth and development of living things, coordination systems, reproduction, and homeostasis in humans, as well as the concept of pressure in physics. In addition, students also learn about electricity, magnetism, and alternative energy sources, chemical reactions and their dynamics, inheritance of traits and biotechnology, as well as environmental issues relevant to everyday life. This course not only emphasizes mastery of the material, but also the appropriate pedagogical approach in conveying these concepts in a contextual and meaningful way to students. Students are encouraged to develop scientific attitudes such as curiosity, critical thinking, and openness to data, as well as scientific investigation skills through inquiry-based activities and science literacy.
CLO	1. Analyzing the growth and development of living organisms and designing effective learning (PLO-3, PLO-4). 2. Analyzing coordination, reproduction, and homeostasis systems in humans and designing contextual teaching strategies (PLO-3, PLO-4). 3. Analyzing the concept of pressure in physics and designing learning that is appropriate to student characteristics (PLO-3, PLO-4). 4. Analyzing the concepts of electricity, magnetism, and alternative energy sources and designing relevant and meaningful learning (PLO-3, PLO-4). 5. Analyzing chemical reactions and their dynamics and designing in-depth learning that is in line with the curriculum (PLO-3, PLO-4). 6. Analyzing the concepts of inheritance and biotechnology and designing contextual learning for students (PLO-3, PLO-4). 7. Analyzing relevant environmental issues and designing learning activities that touch on students' daily lives (PLO-3, PLO-4).

Code	SPI60218
Course Credit	2
Course Name	Biophysics
Description	This course discusses the application of physics principles in biological systems

	to understand life phenomena quantitatively and mechanistically. The study covers biomechanics, bioelectricity and biomagnetism, radiobiology, biological fluid dynamics, thermodynamics of living systems, cell and membrane energy, and the physics of sensory systems (vision and hearing). The course uses a problem-solving approach through interactive lectures, discussions, simulations, and experiments. Students are encouraged to understand the relationship between biophysics concepts and applied issues in medicine, pharmacy, agriculture, animal husbandry, and the environment, as well as their application in contextual science education and local potential.
CLO	1. Applying biomechanics principles to analyze motion and force in the human body system (PLO-3, PLO-7). 2. Applying concepts of bioelectricity and biomagnetism to explain bioelectric processes in the nervous system and organs (PLO-3, PLO-7). 3. Analyzing the working mechanisms of the visual and auditory sensory systems based on the concepts of optics, waves, and acoustics (PLO-3, PLO-9). 4. Evaluating the effects of radiation exposure on biological systems and its implications in radiation protection and radiotherapy (PLO-3, PLO-8). 5. Applying the basic principles of fluid dynamics to understand the dynamics of body fluids and biological circulatory systems (PLO-3, PLO-7). 6. Explaining the application of thermodynamics laws in metabolic processes and energy transfer in living organisms (PLO-3, PLO-4). 7. Analyzing membrane transport processes and biological membrane functions based on physical principles (PLO-3, PLO-9). 8. Examining the relevance and contribution of biophysics in various applied fields such as medicine, pharmacy, agriculture, animal husbandry, and environmental conservation (PLO-5, PLO-10, PLO-11).

Code	SPI60316
Course Credit	3
Course Name	Teaching and Learning of Integrated Science
Description	This theoretical course provides students with a deeper understanding of the concept of integrated science education, integrated science models, and the analysis of integrated science education content. Understanding the concept of integrated science education encourages students to discuss integrated science concepts from various sources and their content. After students understand the concept of integrated science, they discuss integration models. In the final section, students' competency is to analyze journals related to integrated science and its teaching.
CLO	1. Students understand the basic concepts of Integrated Science 2. Students understand models of integration in science 3. Students are able to analyze curriculum competencies (content) that are integrated with other fields of study in science 4. Students are able to report (communicate) the results of content integration analysis 5. Students are able to develop an Integrated Science learning plan matrix 6. Students are able to develop Integrated Science learning tools

Code	SPI60219
Course Credit	2
Course Name	Science in Industrial and Cultural Contexts
Description	This course equips students to analyze the development of science and

	technology through a multihelix and STEAM (Science, Technology, Engineering, Arts, Mathematics) approach in order to support the development of local industrial and cultural products with a focus on: The integration of science (ethnochemistry, ethnophysics, ethnobiology) with local culture-based industries (ceramics, batik, herbal medicine, traditional foods, natural dyes), analysis of scientific concepts in cultural products (gamelan, palace architecture, Joglo houses, etc.), and the application of science in the development of creative industries based on local wisdom and culture.
CLO	1. Analyzing the role of higher education institutions in the development of science and technology toward Indonesia Emas 2045 in the context of multihelix (PLO-7, PLO-8). 2. Analyzing the integration of science, technology, and local culture through the STEAM and multihelix approaches (PLO-3, PLO 7, PLO 8, PLO 9). 3. Exploring ethnoscience (ethnochemistry, ethnophysics, and ethnobiology) as the basis for developing industries based on local culture (PLO-3, PLO 10). 4. Examining the concept of science in local cultural products (the study of science in gamelan, palace architecture and joglo houses, etc.) and creative industries (ceramics, batik, traditional herbal medicine, traditional food, natural dyes, etc.) (PLO-3, PLO-2 and PLO-9). 5. Designing prototypes of innovative industrial products based on science and local culture (PLO-9, PLO-11).

Code	SPI60220
Course Credit	2
Course Name	*Sciencepreneur*
Description	This course aims to equip students with the spirit of entrepreneurship, shape entrepreneurial character, understand entrepreneurial concepts, develop entrepreneurial skills, create innovative products, and market them. The course content covers: developing an entrepreneurial spirit, entrepreneurial character, motivation for achievement, business plans, financing, human resources, business product innovation, production, marketing, and entrepreneurial practice/project learning.
CLO	1. Students have an understanding and awareness of the essence of sciencepreneurship, including its basic concepts, characteristics, and learning objectives through discussions (PLO-3). 2. Students are able to internalize the values and attitudes contained in entrepreneurship, such as work ethic, motivation to achieve, independence, creativity, decision-making skills, and so on through industrial visits and case studies (PLO-2). 3. Students are able to develop innovative entrepreneurial product ideas through independent projects (PLO-2, PLO-10). 4. Students have the skills to produce innovative science-based entrepreneurial products through project activities (PLO-10). 5. Students are able to develop the ability to market innovative entrepreneurial products through projects (PLO-8).

Code	SPI60221
Course Credit	2
Course Name	Scientific Publication in Science Education

Description	This course equips students with the ability to understand the principles of various quantitative research methods and apply them in empirical research, from identifying problems, reviewing theories, developing instruments, analyzing quantitative data in line with developments in science education, to learning the steps of scientific writing, publication ethics, proper writing formats, and the publication process.
CLO	1. Comparing various types of scientific works resulting from science education research and related fields. 2. Analyzing various articles on science education in accredited national journals. 3. Identifying problems/issues in science education and research. 4. Designing ways to solve problems/issues in learning and research in science learning. 5. Writing scientific papers on the results of simple research in the field of science learning.

Additional Competency Course (MKTK)

Code	SPI60222
Course Credit	2
Course Name	Mechanics and Fluids
Description	This course covers the basic concepts and laws of physics related to mechanics and fluids, beginning with an introduction to vectors as a tool for physical analysis. The material covers the motion of particles and rigid bodies in two and three dimensions, particle systems, central forces, Newton's laws, the laws of conservation of momentum and energy, and rotational dynamics. In the topic of fluids, the properties of stationary fluids (fluid statics) are discussed, such as fluid pressure, Pascal's law, Archimedes' principle, capillarity, and viscosity; as well as moving fluids (fluid dynamics) such as the continuity equation and Bernoulli's principle. Students will develop critical thinking and problem-solving skills through mathematical analysis and the application of concepts in real-life contexts, natural phenomena, and developments in mechanics and fluid-based technology.
CLO	1. Explain the basic concepts and operations of vectors and their application in the analysis of motion and force (PLO-3). 2. Explain the kinematics and dynamics of motion of objects in two and three dimensions and Newton's laws (PLO-3). 3. Analyze particle systems, central forces, and the application of the laws of conservation of linear momentum and energy in mechanical systems (PLO-3). 4. Describing and calculating the rotational motion of rigid bodies and rotational dynamics relative to a fixed axis (PLO-3). 5. Explain the concepts of force and equilibrium of rigid bodies in various static and dynamic conditions (PLO-3). 6. Explaining the properties of stationary fluids, including fluid pressure, Pascal's law, Archimedes' principle, capillarity, and viscosity (PLO-3). 7. Analyzing fluid flow using the continuity equation and Bernoulli's principle (PLO-3). 8. Identify and explain technologies developed based on the principles of mechanics and fluids (PLO-3, PLO-7).
Code	SPI60223
Course Credit	2
Course Name	Chemistry Skills

Description	This course develops competencies in mastering the basic principles of producing products related to chemical processes used in households, such as soap, nata, yogurt, flavored salted eggs, VCO, jelly candies, instant powdered drinks, and recreational chemistry/science experiments, as well as product development based on local potential.
CLO	1. Mastering the basic principles of product manufacturing based on chemical processes through discussions and presentations (PLO-3). 2. Ability to create and implement recreational chemistry/science experiment ideas based on chemistry through experimental activities (PLO-2, PLO-3). 3. Able to possess product manufacturing skills through chemical processes (PLO-7). 4. Able to create innovative product ideas based on chemical skills utilizing local potential through project activities (PLO-2, PLO-3). 5. Able to produce innovative chemical products based on local potential through project activities (PLO-9).

Code	SPI60224
Course Credit	2
Course Name	Soil Science
Description	This course develops competencies in the basic concepts of soil science and its applications, including: soil profiles, components, and genesis; soil properties; soil fertility; soil degradation and management (conservation and remediation); in relation to soil health for the environment.
CLO	1. Analyzing soil components and profiles, as well as concepts, factors, and procedures in pedogenesis (PLO-2&3). 2. Analyzing the physical, chemical, and biological properties of soil (PLO-2&3). 3. Analyzing soil fertility. 4. Analyzing soil degradation factors and processes (PLO-2&3). 5. Analyzing management techniques (conservation & remediation) (PLO-2&3). 6. Implementing a biopore hole project as an experiment, as an implementation of one of the soil management techniques (PLO-2,3&10). 7. Creating a learning model about soil degradation and conservation techniques for specific soil conditions (e.g., steep slopes/high elevation angles) (PLO-2,3&9).

Code	SPI60225
Course Credit	2
Course Name	Biochemistry
Description	This course covers the structure and function of major biomolecules (carbohydrates, proteins, lipids, nucleic acids, enzymes), as well as metabolic pathways and mechanisms within cells, including carbohydrate, nitrogen, and nucleic acid metabolism. Students also study biological information systems (replication, transcription, translation, genetic recombination) and their relationship to trait inheritance. Through lectures, practical work, case studies, and pedagogical reflection, students not only understand the basic concepts of biochemistry, but are also able to integrate them into the context of science education in secondary schools. The development of scientific ethics, professional attitudes, laboratory skills, and innovative abilities in designing science and technology-based biochemistry learning are an important part of this course.

CLO	1. Explaining the structure and function of major biomolecules (carbohydrates, proteins, lipids, nucleic acids, enzymes) as the foundation of biochemical processes in cells (PLO-3). 2. Analyze carbohydrate and nitrogen metabolism pathways and regulation, as well as their relationship to cellular function and health (PLO-3). 3. Interpret biological information systems (replication, transcription, translation, genetic recombination) in the context of trait inheritance and basic biotechnology (PLO-3). 4. Conducting basic biochemical experiments scientifically, systematically, and safely, and presenting the results in the form of scientific reports (PLO-7). 5. Developing media or approaches for science education based on biochemical concepts for secondary education in a contextual and innovative manner (PLO-10). 6. Demonstrate scientific attitudes, responsibility, professional ethics, and collaborative work throughout the entire biochemical learning and laboratory process (PLO-2).

Code	SPI60226
Course Credit	2
Course Name	Thermodynamics
Description	This course covers the fundamental principles of classical thermodynamics (reversible) and non-equilibrium thermodynamics (irreversible), as well as their applications in closed, open, and biological systems. The material covers basic concepts of energy, temperature, heat, and entropy, the laws of thermodynamics (zero, first, second, and third), as well as the application of the Carnot cycle, free energy, and thermochemistry. Students will also analyze the relationship between thermodynamics and biological systems, such as organism metabolism and energy flow in ecosystems. Learning is directed towards mastery of concepts, problem-solving applications, and an integrative understanding of science in the context of science education based on local potential and global issues.
CLO	1. Explain and apply basic thermodynamics concepts in solving science problems using a mathematical approach (PLO-3, PLO-7). 2. Analyze enthalpy changes in various reactions and processes based on the basic principles of thermochemistry (PLO-3, PLO-4). 3. Relate the concepts of free energy, spontaneity of reactions, and thermodynamic equilibrium in closed and open systems (PLO-3, PLO-8). 4. Explaining and applying the zeroth law of thermodynamics in understanding thermal equilibrium and temperature measurement (PLO-3). 5. Analyzing and applying the first law of thermodynamics to closed and open systems, as well as its relationship to energy conservation (PLO-3, PLO-7). 6. Explaining the principles of the second law of thermodynamics and analyzing the natural direction of processes and energy efficiency in various systems (PLO-3, PLO-8). 7. Understand the third law of thermodynamics and its implications for entropy and extreme low-temperature conditions (PLO-3). 8. Analyzing the relationship between thermodynamic principles and biological phenomena such as substance transport, organism metabolism, and energy flow in ecosystems (PLO-3, PLO-9).

Code	SPI60227
Course Credit	2
Course Name	Modern Physics

Description	The Modern Physics course covers modern physics concepts such as Relativity: General and Special; Particle-Wave Duality: Photoelectric Effect, X-rays, Compton Effect, Pair Production, de Broglie Waves, Particle Diffraction, Particles in a Box, Uncertainty Principle; Atomic Structure: Atomic Models, Atomic Spectrum, Energy Levels and Spectrum, Atomic Excitation, LASER; Atomic Nucleus: Protons, Neutrons, Size and Shape of the Nucleus, Binding Energy, Atomic Nucleus Models; Radioactivity and Nuclear Reactions: Decay, Half-Life, Radioactive Series, Decay Theory, Cross Section, Fusion and Fission Reactions, Nuclear Reactors. The objective is for students to understand the differences between modern and classical physics and their applications in science.
CLO	1. Conceptually distinguish between the principles of classical physics and modern physics, and understand the scope and importance of modern physics in the development of science (PLO-3). 2. Explain the special and general theories of relativity, including relativistic implications for space, time, mass, and energy (PLO-3). 3. Understand and explain the concept of particle-wave duality, including the phenomena of the photoelectric effect, X-rays, the Compton effect, pair production, de Broglie waves, and particle diffraction (PLO-3). 4. Understanding atomic structure through atomic models, atomic spectra, energy levels, atomic excitation, and the working principle of LASER (PLO-3, PLO-7). 5. Explain the basic concepts of the atomic nucleus, including the composition of the nucleus (protons and neutrons), the size and shape of the nucleus, binding energy, and models of the nucleus (PLO-3). 6. Explain the processes of radioactivity and nuclear reactions, including radioactive decay, half-life, decay theory, fission and fusion reactions, and the basic principles of nuclear reactor operation (PLO-3). 7. Analyzing and evaluating the application of nuclear energy concepts in science and technology, as well as their impact on life and the environment (PLO-3, PLO-7).

Code	SPI60228
Course Credit	2
Course Name	Genetics and Inheritance of Traits
Description	The genetics course covers genes, inheritance of traits, and related aspects. Genetics is an important branch of biology for understanding the diversity of organisms and hereditary traits. The course material covers the history and development of genetics, basic concepts of inheritance patterns, chromosome structure and gene interactions, principles of trait inheritance, Mendelian genetics, population genetics, genetic engineering, gene and chromosome mutations, and gene transfer in bacteria and viruses.
CLO	1. Define the scope of genetics, inheritance of traits, and the development of molecular genetics [PLO-3]. 2. Explain genetic material comprehensively from the history of discovery, packaging, replication, and mechanisms of genetic expression in eukaryotic and prokaryotic organisms [PLO-3]. 3. Outline theories related to genome organization, including concepts of size, nuclear genome organization, and cytoplasmic genome [PLO-3]. 4. Understand the process of genetic expression, including transcription and translation [PLO-3]. 5. Understand the process of cell division (mitosis and meiosis) [PLO-3]. 6. Explain Mendelian genetics theory, including monohybrid and dihybrid crosses, statistical tests, and principles [PLO-3].

Code	SPI60229
Course Credit	2
Course Name	Nutrition and Health Science
Description	This course covers the basic concepts of nutrition and health science, including the classification of nutrients, the physiological functions of nutrients, nutritional needs throughout the life cycle, and their relationship to individual and community health. Students will analyze current nutrition and health issues, such as stunting, obesity, micronutrient deficiencies, and degenerative diseases. The learning approach is oriented toward the integration of natural sciences (biology, chemistry, physics) and pedagogical principles to design contextual and applicable nutrition education at the school level. This course also encourages the development of learning media, nutrition-based entrepreneurship projects, and the strengthening of professional, ethical, and collaborative attitudes.
CLO	1. Explain the basic concepts of macro and micro nutrients and their functions in supporting the body's physiological processes (PLO-3). 2. Analyzing the relationship between nutrition, metabolism, and health at various stages of life (PLO-2, PLO-3). 3. Identify and evaluate community nutrition issues (such as stunting, anemia, obesity) and their impact on quality of life (PLO-2, PLO-8). 4. Applying pedagogical principles and educational technology in designing nutrition education in secondary schools (PLO-4, PLO-8). 5. Developing educational media or projects based on local food potential as an effort to empower communities and educational entrepreneurship (PLO-9, PLO-10). 6. Demonstrate scientific attitudes, professional ethics, collaboration, and responsibility in learning, projects, and nutritional education practices (PLO-2).

Code	SPI60230
Course Credit	2
Course Name	Earth Science
Description	This course covers the fundamental concepts of the Earth system and phenomena occurring both within and outside the Earth. Topics include: introduction to the Earth, minerals and rocks, weathering, surface and groundwater cycles, erosion and deposition, the Earth's atmosphere, crustal movements, earthquakes and their mechanisms, plate tectonics, volcanoes, geological time, and Earth history. Additionally, this course examines various forms of geological hazards such as earthquakes, volcanic eruptions, landslides, and tsunamis. This course also studies the basic principles of disaster mitigation, including risk identification, vulnerability reduction, emergency planning, and the application of adaptive strategies in local and global contexts, so that students can understand the relationship between geological processes and potential disasters and contribute to disaster risk reduction efforts in a scientific and responsible manner.
CLO	1. Explains the basic concepts of the Earth system and its main components, including the interactions between the geosphere, hydrosphere, atmosphere, and biosphere (CLO-3). 2. Identify various types of minerals and rocks and understand their formation processes in the context of Earth geology (CLO-3). 3. Analyzing weathering, erosion, and deposition processes, as well as their impact on the formation and change of the Earth's surface landscape (CLO-3).

	4. Explaining the hydrological cycle, the interaction between surface water and groundwater, and its role in the Earth system (CLO-3). 5. Describing the structure and dynamics of the atmosphere and its relationship to weather, climate, and global climate change (CLO-3). 6. Explaining the mechanisms of tectonic plate movement, earthquakes, and volcanic activity and their impact on the Earth's surface and human life (CLO-3). 7. Interpret geological time and Earth history based on available geological evidence (CLO-3). 8. Analyzing various types of geological disasters such as earthquakes, volcanic eruptions, landslides, and tsunamis (CLO-3). 9. Critically applying the principles of geological disaster mitigation in the form of risk identification, vulnerability reduction efforts, and adaptation strategies based on scientific knowledge and local wisdom (CLO-2, CLO-3, PLO-7).

Code	SPI60231
Course Credit	2
Course Name	Biodiversity
Description	This course provides an understanding of the concepts, components, and classification of biodiversity (*Animalia, Plantae, Protista, Fungi, Archaebacteria, Eubacteria*); natural biological resources and their management; the value and conservation of biodiversity; and the issues and challenges in preserving biodiversity in Indonesia to support sustainable systems.
CLO	1. Understand the concepts and components of biodiversity (PLO-3). 2. Mastering the classification of biodiversity (PLO-3). 3. Mastering biological natural resources and their management (PLO-3). 4. Mastering the value and conservation of biodiversity (PLO-3). 5. Addressing issues and challenges in biodiversity conservation in Indonesia for sustainability (PLO-3, PLO-8).

Code	SPI60232
Course Credit	2
Course Name	Item Response Theory
Description	This course provides an in-depth exploration of the fundamental concepts and applications of *Item Response Theory* (IRT) in test development and analysis. The course begins with an introduction to measurement theory and a comparison between *Classical Test Theory* (CTT) and IRT. Students will learn basic models in IRT, including 1-parameter (Rasch), 2-parameter, and 3-parameter models, and understand *item characteristic curves (*ICC), item parameter and ability (θ) estimation, and item and test information functions. This course also explores the application of IRT in test instrument development and ability evaluation, as well as examining the advantages of IRT over the classical approach. This course is designed to equip students with conceptual and practical skills in applying IRT in the context of educational assessment and psychometrics. In addition, students will also be trained to use computer/statistical applications (e.g., R, QUEST, IRTPRO, Winsteps, or others) to perform IRT-based data analysis.

CLO	1. Explain the basic concepts, IRT models, and main characteristics of Item Response Theory, including differences from classical test theory (PLO-6). 2. Explain and apply procedures for estimating ability parameters and item parameters in one-, two-, and three-parameter IRT models (PLO-6). 3. Evaluate the fit of IRT models to data (model-data fit) using appropriate analysis techniques (PLO-6, PLO-8). 4. Explaining the concept of *ability scales* and their implications in test measurement and interpretation (PLO-6). 5. Analyzing item information and test information and evaluating the efficiency of measurement functions in the context of test design (PLO-6 PLO-8). 6. Designing and developing IRT-based tests (*test construction*) for various measurement purposes in the field of education (PLO-6). 7. Identifying and analyzing potentially biased items (*Differential Item Functioning*) based on the IRT approach (PLO-6). 8. Explaining and applying *test score equating* techniques in the context of developing and administering fair tests (PLO-6). 9. Using computer/statistical applications to perform IRT-based data analysis, including parameter estimation and item characteristic visualization (PLO-5).

Code	SPI60233
Course Credit	2
Course Name	Competency and Professional Development
Description	This course aims to develop competencies in understanding competency development and expertise as a professional science teacher, including mastery of professional ethics to maintain the honor and dignity of the science teaching profession while working as a science teacher on an ongoing basis.
CLO	1. Understanding the nature of the profession and the teaching profession in particular (PLO-4). 2. Understanding the requirements of the teaching profession and the code of ethics for teachers (PLO-4). 3. Mastering the four competencies of teachers (PLO-4). 4. Mastering the duties and roles of teachers (PLO-4). 5. Analyzing the problems faced by teachers and various policies for teacher professional development (competency tests, teacher performance assessments, credit point assessments, Teacher Professional Program (PPG) (PLO-4). 6. Understanding teacher competencies in the context of the 4.0 revolution and 21st-century learning (PLO-4). 7. Understanding the continuous career development of a teacher (PLO-2, PLO-4).

Code	SPI60234
Course Credit	2
Course Name	Review of Research Findings in Science Education
Description	This course equips students with the ability to design, conduct, and communicate research in the field of science education comprehensively, covering trends in science education research, analysis of current issues in science learning, and the development of research relevant to the needs of science education in various contexts.
CLO	1. Analyzing trends and current issues in science education research at the

	national and international levels (PLO-6, PLO 8). 2. Analyzing original, relevant, and feasible types of science education research through national and international journals (PLO-6, PLO7). 3. Appropriate research methodologies according to the research problems and contexts (PLO-6, PLO 7). 4. Analyzing research results in several types of research in national or international journals (PLO-6, PLO-8). 5. Evaluating the impact of science education research on learning (PLO-8, PLO-9). 6. Communicating the results of science education research (PLO-11).

Code	SPI60235
Course Credit	2
Course Name	School-Based Management
Description	This course provides basic concepts of school-based management and its application in educational institutions to support school quality improvement.
CLO	1. Understand the nature, foundations, components, benefits, and characteristics of school-based management (PLO-4). 2. Understand national education standards as a reference for education management (PLO-4). 3. Understanding PAKEM learning as part of the quality of education in MBS (PLO-4). 4. Describe the benefits, types, and ways to encourage community participation in MBS. 5. Explaining the RKT and RKAS (PLO-4). 6. Describe MBS implementation strategies and obstacles (PLO-4). 7. Describing school leadership in MBS and the role of stakeholders in MBS (PLO-4).

Code	SPI60236
Course Credit	2
Course Name	Science Education for Sustainability
Description	This course equips students with the knowledge, skills, and attitudes to integrate sustainable development principles into science education in schools. The material covers the exploration of sustainable development concepts, scientific approaches to problem solving based on local and global issues, and the design of inclusive and equitable STEM-based projects. Students will also develop projects that integrate sustainability principles and STEM approaches, as well as develop teamwork, critical thinking, creativity, innovation, and responsibility skills.
CLO	1. Explain the basic concepts of sustainable development and its relevance to science education (PLO-1, PLO-10). 2. Analyzing local and global issues related to sustainability using a scientific approach (PLO-3, PLO-6) 3. Designing inclusive and equitable STEM-based project solutions to sustainability problems through teamwork (PLO-2, PLO-5, PLO-10). 4. Designing STEM-based science learning projects that integrate the principles of sustainable development (PLO-4, PLO-7, PLO-8). 5. Presenting project outcomes and learning tools logically, systematically, and critically with a professional attitude and responsibility toward their field of expertise (PLO-2, PLO-11).

Code	SPI60237

Course Credit	2
Course Name	Science Computing
Description	This course equips students with the fundamentals of programming using the C++ language for Data Science, to support data analysis and processing activities in the field of Natural Sciences (IPA). The material covered includes an introduction to programming, the use of variables and data types, control structures such as conditions and loops, and iterations (including nested loops and while-loops). Students will also learn the use of mathematical functions and arrays in the context of data processing. This course guides students to develop simple, practical programs in data science, such as reading numerical data, performing calculations, organizing and displaying data, as a first step in scientific computing and data science in Natural Sciences.
CLO	1. Explain the basic concepts of programming and its role in supporting problem solving and data analysis in the field of natural sciences (PLO-5). 2. Understand and use variables and data types in the C++ language to store and process scientific data (PLO-5). 3. Applying conditional structures (*if-else, switch*) in data-driven logical decision-making (PLO-5, PLO-8). 4. Building programs using loops (*for, while, do-while*), including nested loops, to process repetitive data (PLO-5). 5. Using mathematical functions in C++ to solve numerical problems and simple data science-based analysis (PLO-5). 6. Implementing one-dimensional and two-dimensional arrays to efficiently manage scientific data sets (PLO-5). 7. Designing simple programs using C++ to process, analyze, and display data logically and systematically (PLO-5, PLO-7). 8. Integrating C++ programming skills with an introductory approach to data science in the context of solving quantitative problems in science (PLO-5, PLO-7).

Code	SPI60238
Course Credit	2
Course Name	Programming and Robotics
Description	This course develops the competencies of prospective science teachers in integrating programming and robotics concepts with science education based on local potential through the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach. Students will learn to develop interactive learning media, digital science teaching aids, and creative solutions based on microcontrollers (Arduino, Micro:bit) that are relevant to the junior high school/Islamic junior secondary school science curriculum and the actual conditions of schools in various regions. The learning emphasizes the principles of physical computing with the use of local materials and adaptive technology.
CLO	1. Applying visual programming concepts (Scratch/Blockly) and textual programming concepts (Python) to simulate science phenomena related to local potential (e.g., simulating ocean current patterns in coastal areas) (Related to PLO-3, PLO-5, PLO-7). 2. Designing robotics-based science experiments using simple sensors (temperature, light, humidity) integrated with the surrounding environment (Related to PLO-3, PLO-7, PLO-9). 3. Developing digital science teaching aids using local materials (e.g., infrared thermometers from MLX90614 sensors and locally sourced processed wood) with open-source documentation (Related to PLO-5, PLO-9, PLO-10). 4. Utilizing digital simulation platforms (Tinkercad Circuits, PhET) for prototyping learning media prior to physical implementation (Related to

	PLO-5, PLO-7, PLO-8). 5. Building a simple IoT-based monitoring system for long-term observation of scientific phenomena (e.g., measuring school air quality) (Related to PLO-5, PLO-8, PLO-11). 6. Designing creative robotics solutions for local problems (e.g., soil erosion monitoring robots made from recycled materials) using a design thinking approach (Related to PLO-7, PLO-9, PLO-10). 7. Adapting low-cost robotics technology (e.g., cardboard and servo motor arm robots) for schools with limited facilities (Related to PLO-2, PLO-9, PLO-10).

Code	SPI60239
Course Credit	2
Course Name	Applied Statistics
Description	The Applied Statistics course in the Bachelor of Science Education program is a course that provides understanding and skills in applying statistical concepts in various fields. The focus is on the ability to apply statistical theory to solve real-world problems, from data collection and data interpretation to modeling and forecasting. This course covers basic statistical concepts, descriptive statistics, inferential statistics, and the application of statistical software such as SPSS, STATA, or other software.
CLO	1. Explain the basic concepts of applied statistics and their role and benefits in solving research problems in the field of science education (PLO-6). 2. Process and present univariate and multivariate descriptive statistical data accurately and systematically (PLO-6). 3. Conducting assumption or prerequisite tests for statistical data analysis (such as normality, homogeneity, linearity) for univariate and multivariate analysis (PLO-6). 4. Applying parametric and non-parametric inferential statistical analysis in univariate and multivariate contexts to answer research questions in the field of science education (PLO-6). 5. Analyzing relationships between variables using correlation and regression techniques and interpreting the results in the context of science education (PLO-6). 6. Evaluating the validity and reliability of research instruments using appropriate statistical approaches (PLO-6). 7. Using statistical computer applications (such as SPSS, STATA, R Program, or other software) to process and analyze data in science education research (PLO-5).

Code	SPI60240
Course Credit	2
Course Name	Astronomy
Description	This course develops the competencies of prospective science teachers in understanding and teaching astronomical concepts through the integration of modern science with local Nusantara wisdom. Using a STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach, students will explore distinctive astronomical phenomena in Indonesia, develop technology-based adaptive learning media, and design observational activities relevant to local geographical and cultural contexts. The learning process emphasizes the development of applicable astronomical scientific literacy for the junior secondary school level (SMP/MTs).
CLO	1. Analyze unique Indonesian astronomical phenomena (equator, apparent motion of the sun, local tides) using simple and digital observation data

	(Related to PLO-3, PLO-5, PLO-7). 2. Developing a solar system learning model that integrates Nusantara astronomy mythology (example: the solar system in the Balinese cultural perspective) (Related to PLO-1, PLO-3, PLO-9). 3. Conducting moon and constellation observation practices using simple devices (DIY telescopes, smartphone applications) adapted to the geographical conditions of the region of origin (Related to PLO-3, PLO-7, PLO-8). 4. Utilizing astronomy software (Stellarium, Celestia) for simulating Indonesian celestial phenomena and creating digital teaching materials (Related to PLO-5, PLO-7, PLO-11). 5. Exploring traditional calendars (Javanese pranata mangsa, Bugis calendar) as a medium for integrated science-culture learning (Related to PLO-1, PLO-4, PLO-9). 6. Designing interactive learning media about eclipses and moon phases based on local observation data (Related to PLO-5, PLO-9, PLO-10). 7. Developing an astronomy-based educational entrepreneurship project (e.g., a digital traditional astronomical calendar) (Related to PLO-9, PLO-10, PLO-11).

Code	SPI60241
Course Credit	2
Course Name	Computer-Based Learning Media
Description	This course equips prospective science teachers with the competencies to design, develop, and evaluate innovative, interactive, and 21st-century learning-oriented computer-based science learning media. Through the TPACK (Technological Pedagogical Content Knowledge) approach, students will integrate science content, pedagogy, and digital technology while considering the local context and diversity of student learning styles.
CLO	1. Analyze the principles of effective computer-based science learning media design according to the characteristics of science content (PLO-3, PLO-4, PLO-5). 2. Developing interactive presentation media with multimedia integration (Canva, Genially) (PLO-5, PLO-7, PLO-9). 3. Developing digital evaluation tools (Quizizz, Google Forms) (PLO-5, PLO-7, PLO-9). 4. Utilizing virtual simulations of science experiments using the PhET, GeoGebra, or Labster platforms based on local phenomena (PLO-3, PLO-5, PLO-10). 5. Implementing a learning management system (LMS) for hybrid classes with adaptive content (PLO-4, PLO-5, PLO-8). 6. Applying immersive technology (AR/VR) and basic coding (Scratch) to visualize complex science concepts (PLO-5, PLO-9, PLO-10).