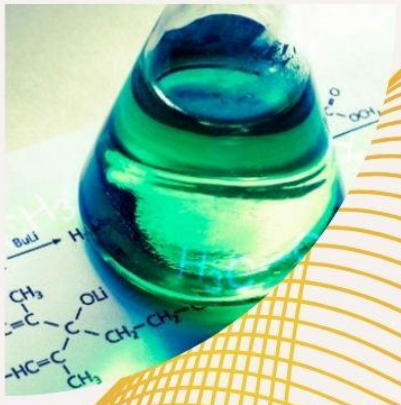
Ministry of Higher Education, Science,
and Technology of The Republic of Indonesia

UNIVERSITAS NEGERI YOGYAKARTA
FACULTY OF MATHEMATICS
AND NATURAL SCIENCES

THE CURRICULUM OF BACHELOR OF CHEMISTRY STUDY PROGRAM



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PREFACE

Praise be to Allah, Lord of the universe. We give thanks to Allah S.W.T. for all His blessings and grace, so that this academic manuscript for the Chemistry Study Program could be compiled and completed properly. This manuscript is an important step in the development of the curriculum and learning in the Chemistry Study Program, Faculty of Mathematics and Natural Sciences, Yogyakarta State University.

We realize that the development of a relevant and high-quality curriculum is very important in supporting the achievement of higher education goals, especially in the field of chemistry. Therefore, the preparation of this academic paper involved various parties, both from within the study program and other related parties, with the aim of producing an educational program that not only produces graduates who are competent in the field of chemistry, but also have the ability to adapt to the ever-evolving developments in science and technology.

This document contains the vision, mission, objectives, curriculum structure, and description of competencies that are expected to be achieved by students of the Chemistry Study Program. We hope that this academic document can serve as a guideline for improving the quality of education in the Chemistry Study Program, as well as a reference for planning and implementing learning activities in the future.

We would like to express our gratitude to the Dean; Vice Dean for Academic Affairs, Student Affairs, and Alumni; Vice Dean for Planning, Finance, General Affairs, and Resources; Vice Dean for Research, Cooperation, Information Systems, and Business; the Quality Assurance Team of the Faculty of Mathematics and Natural Sciences, UNY, lecturers, students, alumni, users, reviewers, and all parties who have contributed their thoughts and support in the preparation of this academic paper. Special thanks to the curriculum development team who worked hard in compiling this academic paper. We hope this paper will greatly benefit the advancement of education in the Chemistry Study Program and its students.

Finally, we hope this academic paper will provide better insight and understanding of the direction of the Chemistry Study Program's development and contribute positively to creating a better academic environment at Universitas Negeri Yogyakarta.

Yogyakarta, 9 April 2025

Study Program Coordinator
Dr. Retno Arianingrum

IDENTITY OF STUDY PROGRAM

Name	:	Chemistry
Establishment Permit	:	240/DIKTI/Kep/1997 15 Agustus 1997
Accreditation Rating	:	Excellent
Accreditation Certificate No.	:	2281/SK/BAN-PT/Akred/S/VIII/2018 Nomor 001/SK/LAMSAMA/K-Akred/S/XII/2022
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DAFTAR ISI

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INTRODUCTION

A. Background

The transformation of Universitas Negeri Yogyakarta (UNY) from a Public Service Agency Based (PTN-BLU/Perguruan Tinggi Badan Layanan Umum) to a Legal Entity State University (PTN-BH/Perguruan Tinggi Negeri Badan Hukum) has resulted in significant changes in learning across all levels. This enhanced autonomy necessitates that every member of the UNY academic community adapt in order to achieve optimal outcomes. A primary responsibility of higher education is to cultivate students' competencies in areas such as superior character, creativity, innovation, piety, independence, critical thinking, and technopreneurship. Consequently, adjustments in learning approaches are essential. The study program curriculum serves as the framework supporting educational initiatives. According to the Regulation of the Minister of Education, Culture, Research, and Technology of the Republic of Indonesia in 2023 with number of 53, the curriculum encompasses graduate learning outcomes, duration, learning methods, and modalities. A key aspect of UNY's transformation is updating the curriculum of Chemistry Study Program. This updated curriculum is intended to align with the rapid advancements in science and technology and to produce graduates equipped to meet the demands of both industry and society. Furthermore, this curricular change addresses global calls for enhancing the quality of higher education while adhering to national and international standards.

At the national level, chemistry programs in university level are required to adhere to the competency standards set by the Ministry of Education and Culture and the National Accreditation Board for Higher Education (BAN-PT/Badan Akreditasi Nasional-Perguruan Tinggi). Moreover, the advancement of scientific research and the evolving demands of the chemical industry necessitate a curriculum that is both practical and focused on empowering students to tackle real-world problems. To ensure that chemistry programs remain relevant and responsive to transformations in education, industry, and research, it is vital to implement curriculum changes. Several factors highlight the urgency of these updates, including:

- **Enhancing Graduate Competencies**: The updated curriculum aims to build graduates who are having not only a solid understanding of fundamental chemical theory but also practical skills which are applicable to industry and research. In the rapid technology advancement, graduates are expected to adapt to the modern chemical industry in the fields of pharmacy, renewable energy, environmental science, and innovative material advancements.
- **Adapting to Evolving Workplace Needs**: Recently, the contemporary workplace has prioritized several valuable skills, such as practical skills, problem-solving abilities, and innovation in order to looking for employee. Consequently, it is important to integrate curriculum into analytical abilities, laboratory skills , and critical soft skills, involving communication, teamwork, and leadership.
- **Enhancing Research Quality**: The proposed of the updated curriculum is to encourage the research to be more interdisciplinary and relevant in tackling global challenges, including climate change, food security, and the innovation of environmentally sustainable materials. This initiative aims to ensure that our research efforts are having relevant and giving impactful in a rapidly changing world.

- **Ensuring Compliance with International Standards**: We are undertaking comprehensive updating to the chemistry curriculum to ensure it aligns with recognized international standards. This strategic is designed to enhance the skills and knowledge of students, ultimately empowering them to excel in an increasingly competitive global landscape.

The implementation of curriculum changes is guided by a set of conditions and regulations, including:

- **Government Regulations and National Education Standards**: In Indonesia, any modifications of curriculum have to align with the policies and regulations issued by the Ministry of Education. This encompasses compliance with the National Education System Constitution and the regulations pertaining to higher education accreditation. Furthermore, these regulations establish the competency standards that each university study program is required to meet, as outlined in the Indonesian National Qualifications Framework (KKNI).
- **International Standards**: The curricula of chemistry study programs should align with international standards to ensure that graduates possess the competencies needed to compete effectively on a global scale. Adhering to these standards is essential for fostering the foundational skills required of future chemistry professionals.
- **Accreditation Evaluation**: The accreditation process overseen by the National Accreditation Board for Higher Education (BAN-PT) has a crucial role in driving curriculum changes. Chemistry programs that do not remain aligned with the latest advancements in education and industry may struggle during the accreditation process, potentially reducing their attractiveness to prospective students.

The updated curriculum for the Chemistry Study Program is designed to build highly competent and innovative graduates who are well-prepared to navigate the challenges of the professional landscape. This curriculum reform encompasses several key features, including:

- **Outcome-Based Approach**: The curriculum prioritizes the outcomes or achiedents seek to attain through their learning experiences. This approach underscores that the main objective of education is to ensure students develop key competencies, which encompass essential knowledge, skills, and attitudes. For chemistry students, these competencies include crucial elements necessary for a thorough understanding of the subject, hands-on laboratory skills, and the ability to adapt to technological advancements and the evolving needs of the industry.
- **Problem-Based and Project-Based Education**: The curriculum emphasizes a strong commitment to project-based learning and case studies, highlighting the practical application of chemical concepts in addressing real-world challenges. Students will participate in research initiatives, engage in technology development, and work towards solutions for environmental and industrial issues.
- **Interdisciplinarity and Collaboration**: The Chemistry study program increasingly prioritizes an interdisciplinary approach, allowing students to investigate the links between chemistry and other disciplines such as biology, physics, and engineering. This methodology equips students with the flexibility needed to tackle the challenges of the industrial sector, which often requires expertise across various fields.
- **Soft Skills Development**: In addition to acquiring technical competencies, the curriculum places a strong emphasis on cultivating essential soft skills, including

communication, management, and leadership. These skills are vital for fostering effective teamwork and successfully leading projects.

- **Industry and Research Engagement**: The new curriculum highlights the significance of collaboration with industry partners, research institutions, and technology developers. A key component of thithe inclusion of internships, which provide students with valuable hands-on experience in both industrial and research laboratory environments.

This curriculum change aims to ensure that graduates of the Chemistry Study Program are well-prepared to take on active roles in addressing global challenges. We anticipate that they will be able to adapt effectively to technological advancements and meet the evolving demands of the job market.

B. Foundations of Curriculum Development

1. Phylosophical Foundation

The chemistry study program curriculum of the 2025 has been developed in alignment with the UNY curriculum, which is rooted in the philosophical principles of Pancasila. This initiative aims to foster knowledge of Pancasila and to serve as a cornerstone for Indonesian civilization. Consistent with UNY's slogan, "Leading in Character Education," the chemistry study program is tasked with the responsibility of contributing to the development of Pancasila knowledge and ensuring its transmission to future generations within the framework of education.

The national culture of Indonesia, as embodied in Pancasila, consists of two fundamental elements driving the nation's historical evolution. The first element is modern culture, underpinned by contemporary knowledge, which shapes Indonesia's identity as a modern nation operating within a national state framework. The second element encompasses indigenous culture, including various religions, which have significantly influenced the aspirations and objectives of Indonesia's civilizational development. The profound impact of religion on the nation's history has given rise to the notion of "Bhineka Tunggal Ika," which is closely related to the concept of "tolerance" in modern culttion highlights the enduring relationship between Indonesia's indigenous and modern cultural landscapes.

Pancasila has evolved as a compromise among diverse socio-political forces to tackle the crises of modern civilization that emerged during the war, which often failed to adequately address global humanitarian issues. The disparities in development among countries have led to significant inequalities, and Pancasila seeks to bridge this divide by integrating spiritual values into contemporary society.

The Pancasila culture serves as the foundation for establishing the quality of knowledge related to Pancasila, which aligns with the ongoing advancement of Indonesian civilization. As of now, Indonesia has yet to be recognized as a developed nation, even after 79 years of independence. This indicates that the country has not effectively formulated its understanding of Pancasila.

Pancasila, as a national culture, should not be taken for granted; it requires the ability to integrate this national identity with the accompanying knowledge systems. A significant concern is the low literacy rates among Indonesian students, as highlighted by the results of the 2023 PISA (Programme for International Student Assessment). While there was a 5% increase compared to 2018, the overall achievement scores have declined. This decline may be attributed to the fact that the implementation of the 2013 Curriculum Revision in 2017

and the Independent Curriculum has not been adequately supported by a theoretical framework that corresponds with modern civilization.

2. Sociological Foundation

This foundation highlights the social factors that can influence and shape the educational process. It emphasizes that the curriculum is more than just a tool for transferring knowledge; it serves as a means to understand, adapt to, and respond to the social dynamics within society. The sociological foundation involves analyzing various elements, including social structures, cultural values, demographic changes, workplace needs, and global challenges that affect society.

The following sociological context was taken into account during the development of Chemistry Study Program Curriculum in the year of 2025:

a. Social and Cultural Change: indonesian society, as well as the global community, is undergoing significant social and cultural transformations, driven largely by globalization, digitalization, and technological advancements. It is essential for the curriculum to adapt to these changes, preparing students to engage actively in an increasingly diverse and dynamic society.
b. Job Market Needs: The dynamics of the labor market are a critical consideration, as graduates are expected to possess competencies that are in alignment with the current demands of the industry. This encompasses not only technical skills but also soft skills and the capacity to adapt to the rapid changes occurring within the workplace.
c. Social Justice and Inclusion: The curriculum should reflect a firm commitment to social justice and inclusion, guaranteeing that all students, irrespective of their socioeconomic background, culture, or gender, have equal access to quality education. This involves actively addressing educational disparities and ensuring that higher education contributes positively to enhancing the overall quality of life in soc

The Chemistry Study Program Curriculum of 2025 has been thoughtfully developed with strong sociological foundation. This foundation is reflected in various aspects of the curriculum, ensuring and relevant educational experience, involving:

a. Responsiveness to Social Needs: The curriculum is crafted to respond to the dynamic social environment by integrating contemporary issues such as environmental sustainability, digital ethics, and social entrepreneurship into courses and academic activities. This approach empowers students to understand and devise solutions for the pressing social challenges faced by society.
b. Flexibility and Adaptability: The Chemistry Study Program Curriculum of 2025 recognizes the diverse needs and backgrounds of students by providing flexible learning pathways through off-campus programs. Students have the opportunity to choose courses, internships, or community projects that align with their interests and career aspirations, allowing them to develop in a manner that reflects the social contexts in which they will ultimately work.
c. Social Character Development: The curriculum highlights the significance of character development and social values such as cooperation, leadership, tolerance, and social responsibility. Through carefully crafted co-curricular and extracurricular activities, students are encouraged to engage with their communities and deepen their understanding of their roles as active and responsible citizens.

Grounded in this sociological framework, the Chemistry Study Program Curriculum of 2025 aspires not only to cultivate academically proficient graduates but also to shape individuals

who are prepared to make positive contributions to society, tackle global challenges, and actively participate in fostering a more just and inclusive community.

3. Physicologica Foundation

In crafting the developed Chemistry Study Program Curriculum, the psychological foundation emphasizes a comprehensive understanding of students as individuals engaged in adult learning. Adult learners exhibit distinct characteristics that set them apart from those at earlier educational levels. Consequently, the educational strategies in higher education must align with the principles of andragogy, which centers on adult-oriented learning. Building on this psychological foundation, this curriculum strives to develop students who are independent, innovative, and capable of adapting swiftly to change. At UNY, the learning experience is centered around the integration of three primary approaches:

a. Learning Theory and Thinking Aspect Development: This curriculum highlights the ways in which students gain several important aspects, such as knowledge, skills, attitudes, and values through various ways including experience, instruction, and engagement with their environment. It is able to promote the development of logical and abstract thinking abilities, enabling students to tackle progressively complex problems as they advance in their learning journey.
b. Emotions: This curriculum extends beyond traditional learning theories and cognitive development by integrating emotional factors into the educational experience. Understanding the influence of emotions on motivation, concentration, engagement, and information processing enables students to manage their feelings more effective. By enhancing emotional intelligence and developing stress management skills, students are able to foster a more productive and enjoyable learning environment, which ultimately contributes to improve an academic performance and overall well-being.
c. Psychomotor: In disciplines that necessitate practical and technical skills, the development of effective psychomotor skills through practice, feedback, and repetition is essential for preparing students to apply their knowledge in real-world scenarios. Learning that incorporates psychomotor skills not only enhances the connection between cognitive processes and physical actions but also elevates the overall quality of education and bolsters students' professional readiness. By focusing on the integration of learning theory with the development of thinking, emotions, and psychomotor aspects in this curriculum, the Chemistry Study Program aspires to cultivate a learning environment that is both flexible and innovative, while being attentive to the diverse needs of students.

This curriculum is crafted to cultivate graduates who possess not only the essential knowledge and skills but also the capacity for continuous learning and adaptation to future challenges. Its goal is to develop individuals who are well-equipped to become leaders and innovators while instilling a strong motivation for lifelong learning.

4. Hystorical Foundation

The historical foundation of this curriculum has a vital role in linking past legacies to present and future needs. This foundation ensures that the curriculum remains adaptable to contemporary developments while preserving and transmitting the nation’s cultural values and rich history to future generations. As a result, students will not only engage with the challenges of their time but will also cultivate a profound understanding of the historical and cultural heritage that shapes their identities as individuals and citizens.

The history of the Chemistry Study Program commenced with the establishment of the Chemistry Education Major, which evolved into the Department of Chemistry Education in 2023, within the Faculty of Mathematics and Natural Sciences at UNY. In 1997, a new undergraduate program in Chemistry was introduced, guided by UNY's mandate to advance pure fields of expertise, including science, technology, social sciences, humanities, and their applications, to foster educational development. The primary commitments of the UNY Chemistry Study Program are: (1) to prepare students to become proficient educators and education personnel who align with the needs of the educational sector in Indonesia; (2) to engage in research and the development of educational science; and (3) to provide community service, particularly in the realm of education.

The integration of Historical Foundations encompasses the following elements:

a. Facilitating Learning in Line with the Times: This curriculum aims to equip students with knowledge and skills pertinent to the contemporary landscape. It encompasses an understanding of emerging technologies, social dynamics, and the global challenges of the 21st century. With a strong historical foundation, the curriculum not only mirrors current developments but also weaves in lessons from the past, enabling students to appreciate how history has influenced the present world.
b. Passing on the Nation's Cultural Values and Golden History: One of the main objectives of the historical foundation to ensure that the curriculum effectively conveys the nation's cultural and historical values to students. The Chemistry 2025 Study Program features components that teach local, national, and global history and culture in an engaging and relevant manner. Students are encouraged to explore and appreciate the nation's rich historical heritage, as well as to understand its role and contributions to the advancement of world civilization.
c. Transforming History into a Modern Context: The historical foundation of this curriculum seeks to integrate historical values and lessons into a contemporary learning context. Students are encouraged to draw upon the wisdom and principles of the nation's rich history to confront current and future challenges. This includes examining successful strategies from the past that can be adapted to resolve modern issues, as well as exploring ethical and moral values that remain pertinent today.
d. Preparing Students for the Era of Industry 4.0 and Society 5.0: This curriculum is structured to equip students to take an active role in the Era of Industry 4.0 and Society 5.0. By providing a historical perspective, the program helps students comprehend how past industrial revolutions have influenced the present and how they can emerge as innovators and leaders in the ongoing digital and social transformation. The curriculum focuses on developing the critical, creative, and collaborative skills essential for interpreting and responding to the dynamics of an ever-evolving landscape.

This curriculum is built on a solid historical foundation, aiming to produce graduates who are not only technically and professionally skilled but also possess a deep understanding of their historical and cultural heritage. This approach enables UNY Chemistry graduates to adapt to changing times and make significant contributions to building a better future, both locally and globally.

1. **Legal Foundation**
   a. The Constitution of the Republic of Indonesia with number 14 of 2005, addresses matters concerning Teachers and Lecturers. This legislation is published in the State

Gazette of the Republic of Indonesia, Number 157 of 2005, and includes a Supplement in the State Gazette, Number 4586.

b. The Constitution of the Republic of Indonesia, Number 12 of 2012, addresses the topic of Higher Education. This is documented in the State Gazette of the Republic of Indonesia Number 158 of 2012, including a supplement designated as Number 5336.
c. The Presidential Regulation of the Republic of Indonesia Number 8 of 2012 concerning the Indonesian National Qualifications Framework called KKNI (In Indonesian);
d. The Government Regulation Number 35 of 2022 concerning the Legal Entity of Higher Education Institutions (Universitas Negeri Yogyakarta);
e. The Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 73 of 2013 concerning the Implementation of the KKNI in the Higher Education Sector;
f. The Regulation of the Minister of Education and Culture No. 7 of 2020 concerning the Establishment, Amendments, and Dissolution of State Universities, and the Establishment, Amendments, and Revocation of Permits of Private Universities;
g. The Regulation of the Minister of Education, Culture, Research, and Technology Number 6 of 2022 concerning Diplomas, Competency Certificates, Professional Certificates, Degrees, and Equivalency of Diplomas from Universities in Other Countries;
h. The Regulation of the Minister of Education, Culture, Research, and Technology Number 13 of 2022 concerning Amendments to Regulation of the Minister of Education and Culture Number 22 of 2020 concerning the Strategic Plan of the Ministry of Education and Culture for 2020-2024;
i. The Regulation of the Minister of Education, Culture, Research, and Technology Number 53 of 2023 concerning Quality Assurance in Higher Education;
j. The Decree of the Minister of Research, Technology, and Higher Education Number 123 of 2019 concerning Internships and Recognition of Industrial Internship Semester Credit Units for Undergraduate and Applied Undergraduate Programs;
k. The Regulation of UNY's Rector Number 1 concerning Academic Guidelines of Universitas Negeri Yogyakarta
l. The Rector's Regulation of UNY Number 15 of 2023 concerning UNY Academic Regulations;
m. The UNY Rector's Decree Number 682 concerning the Revision of the UNY Undergraduate Study Program Curriculum. UNY Rector's Decree Number 4 of 2025 concerning the Universitas Negeri Yogyakarta Curriculum Development Guidelines
n. The UNY Rector's Regulation Number 15 of 2023 concerning Academic Guidelines of Universitas Negeri Yogyakarta;
o. The UNY Rector's Regulation Number 15 of 2023 concerning Academic Regulations of Universitas Negeri Yogyakarta;
p. The UNY Rector's Decree Number 682 concerning Revisions to the Undergraduate Study Program Curriculum of Universitas Negeri Yogyakarta.
q. The UNY Rector's Regulation Number 4 of 2025 concerning Curriculum Development Guidelines of Universitas Negeri Yogyakarta

C. Vision, Mision, and Objectives of University and Faculty

1. Vision, Missions, and Achievements Universitas Negeri Yogyakarta

Vision

To become a world-class university of education that is sustainably excellent, creative, and innovative

Missions

UNY has some missions as follows:

1. organizing sustainably excellent, creative, and innovative academic, vocational, and professional pathway education;
2. organizing research and development in the fields of science and technology, social humanities, sports-health, and arts and culture that are sustainably excellent, creative, and innovative;
3. organizing sustainably excellent, creative, and innovative community service activities for community empowerment and welfare;
4. organizing and building sustainable networks at the national and international levels; and
5. organizing transparent and accountable institutional governance, services, and quality assurance.

Objectives

UNY has some goals as follows:

1. produce graduates who are excellent, creative, innovative, pious, independent, and intellectual;
2. produce discoveries, development, and dissemination of science, technology, arts, and / or sports that improve the welfare of individuals and society, which support regional and national development, and contribute to solving global problems;
3. the implementation of community service and empowerment activities that encourage the development of human potential, society, and nature for community welfare;
4. generating networks involving the community, academics, industry, and media at the national and international levels; and
5. producing transparent and accountable university governance in the implementation of university autonomy.

2. Vision, Missions, and Achievements of Faculty of Mathematics and Natural Sciences

Vision

to establish a faculty that exemplifies superiority, creativity, and sustainable innovation in the fields of mathematics, science, and technology education. Our goal is to foster an environment that is globally competitive in science and related disciplines.

Missions

1) Deliver high-quality, creative, and innovative education that is sustainable and globally competitive in the fields of mathematics, science, and technology.
2) Engage in exceptional, innovative, and globally competitive research and development within mathematics, science, and technology.
3) Implement impactful and creatively sustainable community service initiatives in mathematics, science, and technology to empower society and enhance its welfare.

4) Establish and build sustainable networks in mathematics, science, and technology at both national and international levels.
5) Uphold transparent and accountable governance, services, and quality assurance within the Faculty of Mathematics and Natural Sciences at UNY.

Objectives

1. to build graduates in the fields of mathematics, science, and technology who are exceptional, creative, innovative, dedicated, independent, knowledgeable, and globally competitive.
2. to develop products and innovations in mathematics, science, and technology that enhance the well-being of individuals and communities, thereby supporting regional and national development while contributing to solutions for global challenges.
3. to organize community service and empowerment initiatives in mathematics, science, and technology that foster the development of individual, community, and natural potential, ultimately striving for public welfare.
4. to establish a sustainable network of collaborative partners in mathematics, science, and technology at both national and international levels.
5. to ensure effective, efficient, transparent, and accountable governance in the implementation of the Tri Dharma of Higher Education at the Faculty of Mathematics and Natural Sciences, UNY.

D. The Stages of Curriculum Development

The curriculum development for the UNY Chemistry Study Program is anchored in sound scientific principles and established guidelines.

1. Changes to the curriculum are viewed as essential to adapt to progress in science, technology, art, and culture.
2. This development process builds upon prior curricula through comprehensive evaluations, tracer studies, and in-depth futurist research.
3. The curriculum development is a collaborative endeavor, involving lecturers, students, stakeholders, and other relevant participants, rather than an individual effort.
4. The study program's curriculum development is guided by several crucial documents and frameworks:

a. Guidelines for Developing Higher Education Curriculums in the 4.0 Era;
b. Regulation of the Minister of Education, Culture, Research, and Technology Number 53 of 2023 concerning Quality Assurance in Higher Education;
c. The Indonesian National Qualifications Framework (Presidential Decree Number 8 of 2012), referred to as KKNI, which establishes a competency qualification framework to harmonize, standardize, and integrate education, job training, and work experience, thereby recognizing competencies relevant to job structures across various sectors;
d. SN-DIKTI;
e. The Need for International Accreditation; and
f. Outcome-Based Education (OBE) Policy (see Figure 1).

5. The development of undergraduate programs is structured to align with the standards of KKNI level 6.

The Development of Curriculum (refer to Figure 1) is guided by a comprehensive and objective evaluation of curriculum elements and indicators of success. Several methods can be utilized in this evaluation process, including:

1. Peer Review System: This involves soliciting feedback from alumni, users of alumni, and faculty members to assess the relevance and organization of the curriculum content.
2. Tracer Study: Conducting tracer studies helps identify the relationship between the achievements of curriculum objectives and the demands of the workplace.

3. Student Questionnaire Analysis: Analyzing student responses provides valuable insights into the learning conditions and experiences.
4. Benchmarking: Comparing the curriculum with similar programs at other universities offers additional context and guidance for improvement.

To ensure that the data collected is effective, curriculum evaluations should be conducted periodically, focusing on specific elements or subjects. The results of these evaluations can serve as critical input for future curriculum development.

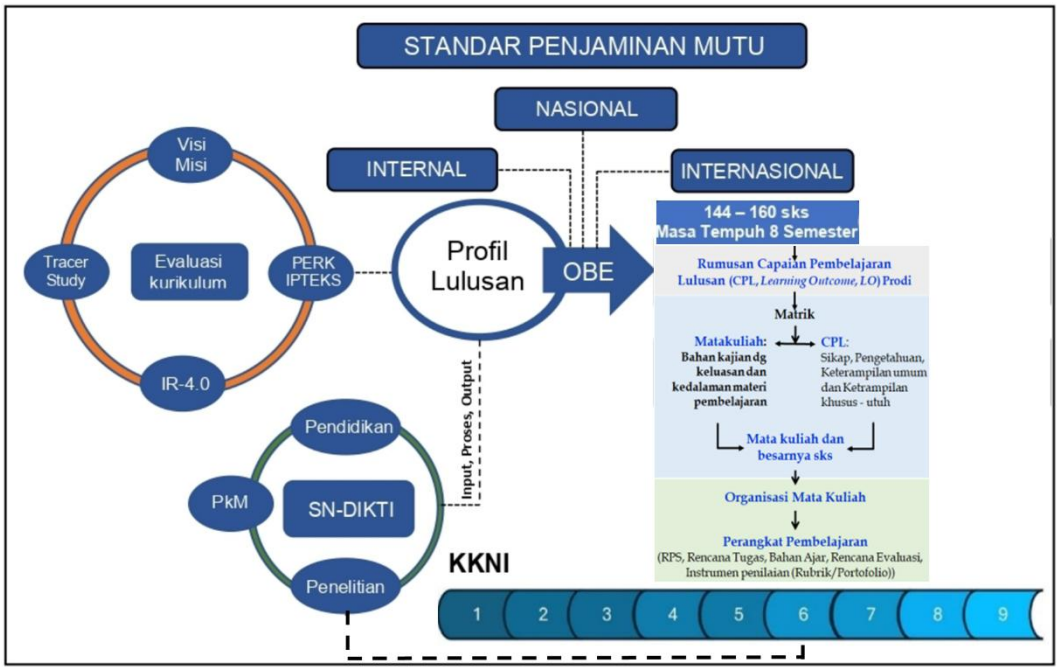

Figure 1. The stages of Curriculum Development

The stages of curriculum development, as illustrated in Figure 1, are detailed as follows:

1. Determining the Graduate Profile
   The graduate profile represents the roles that graduates are expected to fulfill in their specific fields of expertise or work after completing their studies. This profile is established based on an analysis of job market demands, requirements set by the government, the business sector, and industry needs, as well as advances in science and technology. Graduate profiles for study programs are developed collaboratively among similar study programs (prodi) to achieve consensus and serve as a national

reference. To effectively fulfill the roles outlined in the profile, graduates must acquire the skills described in the formulation of the Graduate Learning Outcomes (CPL).

2. Formulating Graduate Learning Outcomes (CPL)
   The determination of learning outcomes is formulated by integrating the necessary attitudes, knowledge, and skills that demonstrate student achievements at the end of the higher education program. This process aligns with the guidelines outlined in the Minister of Education, Culture, Research, and Technology Regulation No. 53 of 2023.
3. Determining Study Materials
   Each item in a study program's CPL includes the study materials that will be used to develop the course content. These materials may encompass one or more branches of science, their sub-disciplines, or a compilation of knowledge that has been synthesized into a new body of knowledge recognized by a forum of similar study programs, reflecting the unique characteristics of the study program's field. Subsequently, the study materials are expanded into detailed learning materials, with their depth and scope referring back to the CPL.
4. Course Formation and Determination of Credit Units
   The formation of courses for the current curriculum involves a thorough evaluation of each course in relation to the established Competency Standards for the study program (CPL). This assessment examines how effectively each course, including its learning materials, assignment formats, exam questions, and assessment methods aligns with the defined CPL. The introduction of new courses is based on specific CPL points assigned to each. The credit unit value of a course is determined by the time required for students to acquire the skills outlined within it. Several factors contribute to the estimation of credit unit weight, including the expected level of proficiency, the depth and breadth of the learning material, and the methodologies or strategies selected to develop those skills.
5. Curriculum Structure Development
   The organization of courses within the curriculum structure must be approached with careful consideration and systematic planning. This ensures that the learning stages for students are appropriate and that the overall educational experience is both efficient and effective in achieving the study program's CPL. The organization of courses involves both horizontal and vertical arrangements. The horizontal organization spreads courses within a semester to enhance students' knowledge and skills in a broader context. In contrast, the vertical organization focuses on enabling students to master skills aligned with increasing levels of learning difficulty, thereby ensuring they meet the established Competency Levels (CPL) of the study program.
6. Learning Process Planning
   Learning process planning entails a systematic approach to several critical activities:
   a. Establishing learning outcomes that serve as clear objectives.
   b. Identifying appropriate strategies and methods to achieve these objectives.
   c. Developing assessment criteria to measure the attainment of learning outcomes.
      The implementation of the learning process involves structured educational activities guided by the instructor and/or teaching team, employing specific learning formats, strategies, and methods. This process is defined by the interaction among students, educators, and educational resources within a designated learning environment.

To facilitate an effective learning experience, the following principles should be upheld:

a. Creating a learning atmosphere that is enjoyable, inclusive, collaborative, creative, and effective.
b. Ensuring equal learning opportunities for all students, irrespective of their educational backgrounds, social, economic, and cultural contexts, linguistic differences, admission pathways, or special needs.
c. Maintaining the safety, comfort, and well-being of the academic community.
d. Providing flexibility within the educational process to support lifelong learning.

7. Learning Assessment Planning

   The assessment of the learning process evaluates both the planning and implementation phases, with the objective of enhancing overall educational effectiveness. This assessment may be conducted by educators and/or a dedicated team in coordination with the study program management unit. The evaluation of learning outcomes is carried out in a manner that is valid, reliable, transparent, accountable, fair, objective, and conducive to educational development. It includes both formative and summative assessments.

   Formative assessments serve the purpose of:

   a. Monitoring the progress of student learning.
   b. Providing constructive feedback to help students achieve their learning outcomes.
   c. Enhancing the overall learning process.

      Summative assessments focus on evaluating student learning outcomes to determine course completion and program fulfillment, in accordance with established graduate learning outcomes. These assessments may take various forms, including written examinations, oral evaluations, project assessments, assignment evaluations, competency tests, and other relevant assessment formats.

CURRICULUM OF CHEMISTRY STUDY PROGRAM

A. Rational

The Chemistry Study Program at the Faculty of Mathematics and Natural Sciences, Yogyakarta State University (FMIPA UNY) is an educational program designed to provide a deep understanding of various aspects of chemistry. This program emphasizes not only theory but also the mastery of practical skills that are essential for students to be able to apply chemistry in the real world. Graduates of this program are expected to have the ability to analyze, synthesize, and solve problems related to various fields of chemistry.

This study program aims to produce graduates who have a deep understanding of basic chemistry principles and are able to apply this knowledge in various fields, such as industry, health, the environment, and scientific research. With the advancement of technology and the rapid development of the industrial world, the need for human resources with high competence in the field of chemistry is increasing. Therefore, the development of a new Chemistry Study Program curriculum is very important. This new curriculum is designed to respond to global challenges by providing broader knowledge of its applications in industry, research, and education. This aims to produce graduates who are ready to compete in the global job market and able to adapt quickly to changes.

The rationale for developing a new chemistry study program curriculum lies in several factors, including:

1. Advances in Science and Technology: Chemistry continues to evolve with the emergence of new discoveries, technologies, and increasingly complex applications. Therefore, the curriculum must be updated to remain relevant to the latest scientific and technological advances.
2. Industry Demands: The chemical industry and related sectors require a skilled workforce that is ready to face global challenges. The new curriculum must include the practical skills and analytical abilities required by industry.
3. Competitive Human Resource Development: To ensure that graduates are able to compete at a global level, the curriculum must integrate an approach that supports the mastery of technical skills as well as soft skills such as problem solving, communication, and creativity.
4. Demand for Improved Education Quality: In order for chemistry study programs to remain relevant to the developing needs of society and the world of work, continuous curriculum development is necessary to improve the quality of education and ensure that graduates have competencies that meet global standards.

With this curriculum development, it is hoped that the UNY Chemistry Study Program can produce graduates who are not only competent in the field of chemistry, but also have critical, creative, and innovative thinking skills. The graduates are expected to be able to contribute significantly to the development of science, technology, and sustainable chemical industry, as well as be ready to face challenges and opportunities in the global market.

B. Evaluation and *Tracer Study*

Curriculum development is based on the results of evaluations and recommendations regarding the curriculum currently in use. Evaluations are based on reviews by stakeholders, namely lecturers, students, alumni, and partners/users of alumni. Evaluations are also based on changes in regulations, changes in the vision and mission of the institution and the scientific vision of the study program, associations of

similar study programs, the community, developments in science and technology, and others.

1. Curriculum Evaluation and Tracer Study Results

A summary of the results of the evaluation of the Chemistry Study Program curriculum is presented in Table 1.

Table 1. Summary of Curriculum Evaluation and Tracer Study Results

Input Content	Level of Importance					Acceptance	
	5	4	3	2	1	Yes	No
A. Input and Needs from the Community							
1. Chemistry graduates not only master technical aspects of laboratory work, but also possess communication, leadership, teamwork, and presentation skills, enabling them to compete in an increasingly collaborative workplace.	√					√	
2. There is a push for students to not only be directed toward becoming workers, but also job creators. Strengthening entrepreneurship courses based on chemical products or waste processing into innovation is important.	√					√	
B. Input and Requirements from the Workplace/Industry							
1. Bachelor of Chemistry graduates are not solely intended to become chemical analysts, but also need to be equipped with basic management knowledge. This training aims to improve graduates' interpersonal skills, such as communication, discussion, interaction with superiors, and leadership skills. Therefore, it is recommended that there be a special course (2 credits) covering planning, organizing, controlling, and leadership, which can be applied from the early stages of study.	√					√	
2. Providing training related to management to the Chemistry Student Association team is considered important to support the effectiveness of the organization.		√				√	
3. Although the technical competence of chemistry graduates is still needed, strengthening self-development skills through an understanding of management science is a more urgent aspect to consider.	√					√	
C. Input and Needs from Alumny							
1. It is necessary to add to the graduate profile of the Chemistry Study Program the ability to serve as a lecturer or teacher at the school level, in addition to being competent in industry and research.	√					√	

Input Content	Level of Importance					Acceptance	
	5	4	3	2	1	Yes	No
2. Several elective courses are designed to be relevant to the needs of the workplace, and it is necessary to review the course material to ensure that graduates acquire the appropriate skills to face challenges in the professional world.	√					√	
3. The distribution of courses related to the duration of field work practice can be extended to more than one month, and there needs to be changes to elective courses covering industry and entrepreneurship. Additionally, it is recommended to add elective courses on cosmetology.	√					√	
D. Input and Requirements from Graduate Users							
1. The vision and mission of the study program are generally still relevant, but further elaboration is needed regarding the strategies that will be pursued to achieve these objectives..	√					√	
2. The addition of CPL related to foreign language proficiency needs to be considered, especially given the existence of a reference laboratory at the Faculty of Pharmacy that collaborates internationally. This situation requires graduates to have adequate English language skills, both spoken and written	√					√	
3. The relevance of the study program's courses to developments in science and technology is still maintained, but it is recommended to supplement them with the latest learning methods and instruments to improve the quality of the learning process.	√					√	
E. Input from Students							
1. Educational and research activities, particularly in the field of technology, have the potential to be developed into innovative solutions to existing problems, while also offering a competitive edge on the global stage..	√					√	
2. Regular curriculum evaluation is important in order to keep pace with developments, particularly in data management and the use of digital technology.	√					√	
F. Input and Requirements from the Government (Legislation)							
1. In line with sustainable development goals (SDGs), the government encourages the development of curricula that emphasize	√					√	

Input Content	Level of Importance					Acceptance	
	5	4	3	2	1	Yes	No
green chemistry, waste management, energy efficiency, and sustainable use of natural resources.							
2. To support comprehensive learning outcomes, the government recommends the implementation of innovative learning methods such as project-based learning, case method, and team-based projects, which are relevant to solving real problems in the field of chemistry.	√					√	
G. nput from the Accreditation Agency							
1. It is important that the CPLs formulated truly reflect the desired graduate profile, in terms of attitude, knowledge, and skills. CPLs must be specific and measurable, and logically translated into course subjects.	√					√	
2. The curriculum must be clearly mapped to national standards and the Indonesian National Qualifications Framework (KKNI), and demonstrate the relationship between CPL, courses, learning methods, and evaluation. This document serves as evidence of academic consistency, which is important in accreditation assessments.	√					√	
H. Input and Requirements from the Department							
1. Replacing the word "reputable" in the vision statement with "excellent" may be more appropriate, in order to align with the terminology used by universities and faculties.	√					√	
2. The Learning Outcomes for Graduates (CPL) of the Bachelor of Chemistry Study Program need to be designed in accordance with the latest Ministry of Education, Culture, Research, and Technology Regulation No. 53 of 2023 concerning Quality Assurance in Higher Education, which covers the aspects of attitude (S), general skills (KU), specific skills (KS), and knowledge (P), with the aim of producing graduates who are innovative, competitive, and have global competitiveness.	√					√	
3. Graduates of the Bachelor of Chemistry Study Program are expected to have competencies that are in line with developments in science, technology, and the arts (IPTEKS), and are able to respond to the needs of the world of work in various sectors. With reference to the National Higher Education Standards and the latest policies, Bachelor of Chemistry graduates are projected to have the following	√					√	

Input Content	Level of Importance					Acceptance	
	5	4	3	2	1	Yes	No
profiles: quality control and quality assurance analysts and controllers, researchers and innovators in the field of chemistry, environmental and sustainability experts, science and technology-based entrepreneurs, science educators and communicators, chemical safety and regulation specialists, and experts in the field of materials and energy technology.							
I. Input and Requirements from the Faculty							
1. To ensure that Graduate Learning Outcomes (GLOs) are developed in a specific and relevant manner to meet the needs of the job market, and can be consistently integrated into the curriculum, teaching, and assessment	√					√	
2. Improving the quality of laboratory activities through the strengthening of laboratory Standard Operating Procedures (SOPs), the procurement of modern equipment, and the training of laboratory staff and faculty to support safe and up-to-date laboratory-based learning	√					√	
J. Input and Requirements from Universities							
1. To support the internationalization of the university, it is recommended that the curriculum includes strengthening academic English language skills, as well as opening up opportunities for international cooperation such as credit transfer, joint courses, or guest lectures from overseas partners	√					√	
2. Emphasizing the importance of conducting periodic curriculum evaluations involving stakeholders (lecturers, alumni, graduate users), and integrating the results of tracer studies and industry needs as a basis for curriculum development	√					√	
3. There are directives that the curriculum should not only focus on scientific aspects, but also equip students with soft skills (communication, leadership, teamwork) and an entrepreneurial spirit, including the potential for developing innovative chemistry-based products	√					√	

Explanation: 5 = very important, 4 = important, 3 = fairly important, 2 = not important, 1 = not very important

2. Perubahan Kurikulum Program Studi

The curriculum changes made based on the results of the Curriculum and Tracer Study evaluation are summarized in Table 2.

Table 2. Dimensions of Changes in the Results of the Curriculum and Tracer Study Evaluation

Components of Change	Curriculum 2020	Curriculum 2025
1. Graduate profile	produce Bachelor of Science (S.Si.) graduates in Chemistry who are excellent, creative, and innovative, based on piety, independence, and intellectualism	produces Bachelor of Science (S.Si.) graduates in Chemistry who are excellent, creative, and innovative, based on piety, independence, and intellectualism. Graduates of the Chemistry Study Program are equipped with reliable abilities and skills to be able to continue to a higher level.
2. Vision and mission of the study program	The vision of the Chemistry Study Program at FMIPA UNY is "by 2025, to become a reputable study program in Southeast Asia in producing chemistry graduates who are academically capable, professional, excellent, creative, innovative, and highly competitive in the field of chemistry based on piety, independence, and intellectualism."	he vision of the Chemistry Study Program at FMIPA UNY is "to become a study program that is excellent, creative, and innovative in the field of chemistry based on research oriented towards sustainable development goals, as well as producing graduates who are competent and globally competitive."
3. Program Learning Outcomes	presented in detail, including attitudes, knowledge, specific skills, and general skills (based on Permendikbud No. 3 of 2020)	presented as an integrated whole of competencies, including attitudes, knowledge, specific skills, and general skills (based on Permendikbudristek No. 53 of 2023)

Table 3. Dimensions of Changes in Credit Hours

Courses	UCTS	ECTS	Courses	UCTS	ECTS
Curriculum 2020 (Revision 2022)			**Curriculum 2025**		
General University Courses (MKU)	14	22.4	Compulsory Curriculum Courses (MKWK)	8	12.8
Elective University Courses (MKU)	2	3.2	Compulsory University Courses (MKWU)	6	9.6
Faculty Courses	4	6.4	Faculty Courses (MKF)	4	6.4
Chemistry Study Program Courses	80	128	Required Program Foundation Courses (MKPKP)	76	121.6
Advanced/flagship/distinctive/specialization courses in the Chemistry Study Program	26-36	41.6-57.6	Elective Program Foundation Courses (MKPKP)	24-40	38.4-64
Main Course Groups: PKL, KKN, and TAS	20	32	Out-Campus Learning Courses (MKPLK)	12	19.2
			Academic Development Courses (MKPK)	11	17.6
			Additional Competency Courses (MKTK)	3	4.8
Total Credits	**146-156**	**233.6-249.6**	**Total Credits**	**144-160**	**224-256**

Table 4. Course Equivalence

Curriculum 2020 (Revision 2022)				Curriculum 2025			
Code	**Course**	**UCTS**	**ECTS**	**Code**	**Course**	**UCTS**	**ECTS**
MKU620-	Religion	2	3.2	MWK60201-7	Religion	2	3.2
MKU6207	Civics Education	2	3.2	MWK60207	Civics Education	2	3.2
MKU6208	Pancasila	2	3.2	MWK60208	Pancasila	2	3.2
MKU6209	Bahasa Indonesia	2	3.2	MWK60209	Bahasa Indonesia	2	3.2
MKU6211	English	2	3.2	MWU60201	English for Specific Purpose	2	3.2
MKU6212	Digital Transformation**	2	3.2	MWU60203	Sustainable and Education Development	2	3.2
MKU6213	Creativity, Innovation, and Entrepreneurship **	2	3.2	SKM60303	Chemistry Enterpreneurship	3	4.8
MKU6216	Social and Humanitarian Literacy	2	3.2	MWU60202	Sports and Physical Fitness	2	3.2
FMI6201	Science Insights and Studies	2	3.2	FMI60201	Science Insights and Studies	2	3.2
FMI6202	Statistics	2	3.2	FMI60202	Statistics	2	3.2
KIM6401	Fundamental Chemistry	4	6.4	SKM60401	Fundamental Chemistry	4	6.4
KIM6303	Mathematics for Chemistry	3	4.8	SKM60201	Mathematics for Chemistry	2	3.2
KIM6202	Physics for Chemistry	2	3.2	SKM60202	Physics for Chemistry	2	3.2
				SKM60203	Biology for Chemistry	2	3.2
KIM6404	Chemical Equilibrium	4	6.4	SKM60402	Chemical Equilibrium	4	6.4
KIM6406	Basic of Organic Chemistry	4	6.4	SKM60403	Fundamental of Organic Chemistry	4	6.4
KIM6309	Non-Metal Inorganic Chemistry	3	4.8	SKM60404	Fundamental of Inorganic Chemistry	4	6.4
KIM6410	Fundamentals of Analytical Chemistry	4	6.4	SKM60405	Fundamentals of Analytical Chemistry	4	6.4
KIM6405	Molecular Dynamics	4	6.4	SKM60406	Molecular Dynamics	4	6.4
KIM6307	Structure and Reactivity of Organic Compounds	3	4.8	SKM60408	Structure of Polyfunctional Organic Compounds	4	6.4
KIM6308	Metal Inorganic Chemistry	3	4.8	SKM60301	Basic of Inorganic Reactions	3	4.8
KIM6311	Chemical Separation Methods	3	4.8	SKM60302	Chemical Separation Methods	3	4.8
KIM6412	Biochemistry	4	6.4	SKM60407	Biochemistry	4	6.4
KIM6214	Environmental Chemistry	2	3.2	SKM60204	Environmental Chemistry	2	3.2
KIM6227	Basic of Computational Chemistry	2	3.2	SKM60205	Fundamental of Computational Chemistry	2	3.2
KIM6215	Quantum Chemistry	2	3.2	SKM60206	Quantum Chemistry	2	3.2
KIM6219	Physical Organic Chemistry	2	3.2	SKM60207	Physical Organic Chemistry	2	3.2

Curriculum 2020 (Revision 2022)				Curriculum 2025			
Code	**Course**	**UCTS**	**ECTS**	**Code**	**Course**	**UCTS**	**ECTS**
KIM6322	Coordination Chemistry	3	4.8	SKM60409	Coordination Chemistry and Organometallic	4	6.4
KIM6237	Organometallic	2	3.2				
KIM6324	Chemical Instrumentation	3	4.8	SKM60410	Chemical Instrumentation	4	6.4
KIM6225	Chemistry Laboratory Management	2	3.2	SKM60208	Chemistry Laboratory Management	2	3.2
				SKM60209	Advanced Biochemistry	2	3.2
KIM6217	Colloid and Surface Chemistry	2	3.2	SKM60210	Surface Chemistry	2	3.2
				SKM60211	Mechanism of Inorganic Reaction	2	3.2
KIM6216	Atomic and Molecular Spectroscopy	2	3.2	SKM60212	Atomic and Molecular Spectroscopy	2	3.2
KIM6220	Elucidation of Organic Compound Structures	2	3.2	SKM60213	Elucidation of Organic Compound Structures	2	3.2
KIM6234	Analysis of Inorganic Compound Structures	2	3.2	SKM60214	Elucidation of Inorganic Compound Structures	2	3.2
KIM6229	Selected Topics in Chemical Research	2	3.2	SKM60215	Selected Topics in Chemical Research	2	3.2
KIM6218	Polymer Chemistry	2	3.2	SKM60216	Polymer Chemistry	2	3.2
KIM6213	Nuclear Chemistry	2	3.2	SKM60217	Nuclear Chemistry	2	3.2
KIM6228	Advanced Computational Chemistry	2	3.2	SKM60218	Advanced Computational Chemistry	2	3.2
KIM6231	Chemical Applications of Group Theory	2	3.2	SKM60219	Chemical Applications of Group Theory	2	3.2
KIM6232	Inorganic Chemical Synthesis	2	3.2	SKM60220	Inorganic Chemical Synthesis	2	3.2
KIM6223	Crystal Chemistry	2	3.2	SKM60221	Crystal Chemistry Solid State Inorganic Chemistry	2	3.2
KIM6233	Solid State Inorganic Chemistry	2	3.2				
KIM6235	Nanochemistry Technology	2	3.2	SKM60222	Nanochemistry Technology	2	3.2
KIM6236	Bioinorganic Chemistry	2	3.2	SKM60223	Bioinorganic Chemistry	2	3.2
KIM6238	Materials Chemistry	2	3.2	SKM60224	Materials Chemistry	2	3.2
KIM6239	Membrane Technology	2	3.2	SKM60225	Membrane Technology	2	3.2
KIM6240	Catalytic Chemistry	2	3.2	SKM60226	Catalytic Chemistry	2	3.2
KIM6259	Geochemistry	2	3.2	SKM60227	Geochemistry	2	3.2
KIM6241	Pharmaceutical Chemistry	2	3.2	SKM60228	Pharmaceutical Chemistry	2	3.2
KIM6242	Molecular Biotechnology	2	3.2	SKM60229	Molecular Biotechnology	2	3.2
KIM6243	Food Materials Chemistry	2	3.2	SKM60230	Food Materials Chemistry	2	3.2
KIM6244	Synthetic Organic Chemistry	2	3.2	SKM60231	Synthetic Organic Chemistry	2	3.2
				SKM60232	Cosmetics Chemistry	2	3.2

Curriculum 2020 (Revision 2022)				Curriculum 2025			
Code	**Course**	**UCTS**	**ECTS**	**Code**	**Course**	**UCTS**	**ECTS**
				SKM60233	Forensic Chemistry	2	3.2
KIM6221	Natural Materials Chemistry	2	3.2	SKM60234	Isolation and Identification of Natural Compounds	2	3.2
KIM6245	Isolation and Identification of Natural Compounds	2	3.2				
KIM6246	Mechanisms of Organic Compound Reactions	2	3.2	SKM60235	Mechanisms of Organic Compound Reactions	2	3.2
KIM6247	Toxicology	2	3.2	SKM60236	Toxicology	2	3.2
KIM6248	Enzymology	2	3.2	SKM60237	Enzymology	2	3.2
KIM6249	Petroleum and Energy Chemistry	2	3.2	SKM60238	Petroleum and Energy Chemistry	2	3.2
KIM6250	Fermentation Technology	2	3.2	SKM60239	Fermentation Technology	2	3.2
KIM6262	Medicinal Chemistry	2	3.2	SKM60240	Medicinal Chemistry	2	3.2
KIM6226	Physical Biochemistry	2	3.2	SKM60241	Physical Biochemistry	2	3.2
KIM6251	Analytical Electrochemistry	2	3.2	SKM60242	Analytical Electrochemistry	2	3.2
KIM6252	Corrosion and Electroplating Chemistry	2	3.2	SKM60243	Corrosion and Electroplating Chemistry	2	3.2
KIM6254	Radioanalysis	2	3.2	SKM60244	Radioanalysis	2	3.2
KIM6255	Management of Hazardous and Toxic Waste	2	3.2	SKM60245	Management of Hazardous and Toxic Waste	2	3.2
KIM6256	Surfactant and Additives	2	3.2	SKM60246	Coloid and Surfactant	2	3.2
KIM6253	Industrial Materials Analysis	2	3.2	SKM60247	Industrial Materials Analysis	2	3.2
KIM6257	Industrial Chemistry	2	3.2	SKM60248	Industrial Chemistry	2	3.2
KIM6258	Industrial Management	2	3.2	SKM60249	Industrial Management	2	3.2
				SKM60250	Data Science and Chemical Programing	2	3.2
KIM6330	Research Methodology	3	4.8	MKK60301	Research Methodology	3	4.8
KIM6863	Thesis	8	12.8	MKK60801	Thesis	8	12.8
PKL6601	Field Work Practice (PKL)	6	9.6	MLK60602	Field Work Practice (PKL)	6	9.6
MKU6614	Community Service	6	9.6	MLK60605	Community Service	6	9.6

C. Vision, Mision, and Objectives of Study Program

1. Academic Vision of the Study Program

The vision of the Chemistry Study Program at FMIPA UNY is "**to become a study program that is excellent, creative, and innovative in the field of research-based chemistry oriented towards sustainable development goals, as well as producing competent graduates who are globally competitive**" The scientific vision of the UNY Chemistry Study Program covers several important aspects:

1) Excellent, Creative, and Innovative

To become an excellent chemistry study program in the development of chemical science and technology, as well as playing an active role in creating solutions to global challenges through creative and innovative approaches.

2) Competent and Globally Competitive Graduates
   The Chemistry Study Program is committed to producing graduates who are academically, practically, and professionally competent in the field of chemistry and capable of contributing significantly to scientific innovation, industry, and sustainable development at the national and international levels.
3) Research Oriented Towards Sustainable Development Goals
   The Chemistry Study Program was developed to become a center for in-depth, applied chemical science research and development that contributes to solving real-world problems through research oriented towards Sustainable Development Goals.

2. Mision of the Study Program

The mission of the study program is the effort made by the study program in accordance with its functions and duties to realize the established vision. The mission of the study program is derived from the vision of the study program in line with the institutional vision, namely the vision of the faculty and university.

a. Quality and research-based chemistry education and teaching to produce graduates who are professional, ethical, and adaptive to developments in science and technology.
b. Chemistry research that supports the development of chemistry and technology that is beneficial for improving the quality of human life and sustainable national development.
c. Community service through efforts to disseminate and apply the results of chemistry research and development and participate in creating a scientific, democratic, and independent society to support environmentally-friendly national development.
d. Strategic cooperation and partnerships with domestic and foreign institutions in order to strengthen the three pillars of higher education and increase the global competitiveness of graduates.
e. Guidance for the academic community to become members of a campus community that is excellent, creative, and continuously innovative, as well as having a love for the nation, state, and homeland.

3. Objectives of the Study Program

a. Formulation of Program Study Objectives

The educational objectives of a study program, also known as Programme Educational Outcomes (PEOs), are statements that broadly describe the career and professional achievements that the study program prepares its graduates to attain within the first few years (3-5 years) after graduation (Abet, 2008). The objectives of the study program are in line with the scientific vision of the study program and the institutional vision, namely the vision of the faculty and university.

Objectives of the Chemistry Study Program, UNY

PO 1:	Produce graduates who are able to apply their knowledge and skills in chemistry creatively and innovatively in industry, research, and practical applications, as well as contribute to sustainable development
PO 2:	Produce graduates who are able to manage and publish research results in the field of chemistry, adapt to technological developments, and be globally competitive
PO 3:	Equip graduates with critical thinking, ethical, and responsible skills in the field of chemistry and multidisciplinary fields

b. Alignment of Objectives with the Vision of the Study Program, Faculty, and University

The alignment between the objectives of the study program and the vision of the study program, faculty, and university is recorded as follows.

Table 5. Matrix of Program Objectives (TP) Alignment with University, Faculty, and Study Program Vision

PO	UNY Vision			Faculty Vision			Study Program Vision		
	Excellent	Creative	Inovative Sustainable	Excellent	Creative	Inovative Sustainable	Excellent	Creative	Inovative Sustainable
PO 1	√	√	√	√	√	√	√	√	√
PO 2	√	√		√	√		√	√	
PO 3	√	√	√	√	√		√	√	√

c. Alignment of Study Program Objectives with KKNI

The competency levels in the Indonesian National Qualifications Framework (KKNI) are level 6 for bachelor's degrees, level 8 for master's degrees, and level 9 for doctorates. The following is an example of identifying the alignment of study program objectives (TP) with the KKNI description for level 6 bachelor's degrees.

Table 6. Alignment of Chemistry Study Program Objectives with KKNI Level 6

KKNI Level 6 Descriptor	**PO**		
	PO1	**PO2**	**PO**
Mastering chemical science theory and being able to develop professionally, providing alternative solutions to problems in the field of chemistry, as well as compiling and communicating scientific work effectively.	√	√	√
Being able to apply laboratory knowledge and skills in the chemical industry and develop professionally in solving industrial problems.	√	√	√
Being able to develop and apply entrepreneurial principles in the field of chemistry.	√	√	√

D. Strategic Objectives of the Study Program

As an elaboration of the Vision, Mission, and Objectives of the Study Program that are in line with the Vision, Mission, and Objectives of Education at the faculty and university levels, the Strategic Objectives of the UNY Bachelor of Chemistry Study Program are formulated as follows:

a. Improvement in Graduate Quality
   - Increasing the average GPA of graduates and the length of study on time.
   - ncrease the percentage of graduates working in relevant fields within ≤ 6 months after graduation.
   - Improve the global competence of graduates, including foreign language proficiency and involvement in international activities.

b. Improving the Quality of Learning and Curriculum

- Implementing an OBE (Outcome-Based Education) curriculum that is aligned with the SDGs
- Increasing the use of active, innovative, and digital learning methods.
- Integration of sustainable development and green chemistry topics into the curriculum.

c. Strengthening Research Capacity and Scientific Publications
- Increasing the number and quality of research conducted by lecturers and students.
- Increasing the number of publications in accredited national journals and reputable international journals.
- Increasing the number of collaborative research projects, including those with foreign partners.

d. Improvement of Research-Based Community Service
- Improving the quality and quantity of chemistry research-based community service activities.
- Encouraging the application of research results to solve local or national problems.

e. Improvement of Cooperation and Networking
- Increasing the number of collaborations with domestic and foreign universities, industries, and research institutions.
- Increasing the mobility of lecturers and students (exchanges, internships, conferences, etc.).

f. Penguatan Tata Kelola dan Sistem Penjaminan Mutu Internal
- Realizing transparent, accountable, and performance-oriented study program governance.
- Optimizing a sustainable quality assurance system in accordance with the standards of the accrediting agency.

E. Graduate Profile

1. Graduate Profile and Profile Description

A graduate profile is a description of the characteristics or roles that graduates can perform in a particular field of expertise or work after completing their studies. The following is the graduate profile of the Chemistry Study Program, Faculty of Mathematics and Natural Sciences, Yogyakarta State University.

Table 7. Profile of Chemistry Program Graduates

Graduate Profile	Profile Description
Chemical Analyst	Graduates of the Chemistry Study Program are equipped with reliable abilities and skills to work as chemical analysts. These abilities and skills include: (1) in-depth mastery of theoretical concepts in the field of chemical analysis, as well as the ability to formulate procedural solutions in the field of chemical analysis and its applications, (2) managerial mastery in applying chemical analysis tasks, including: sample preparation, selection of chemical analysis test methods, use of instruments, analytical data processing, and laboratory preparation based on occupational safety and health (OSH).
Research assistants in the field of chemistry in industry, formal and informal institutions	Graduates of the Chemistry Study Program are equipped with reliable abilities and skills to work as research assistants, including: (1) mastery of concepts, procedures, and research ethics in the field of chemistry, (2) management of research data

	for the purposes of authentication and originality in chemistry studies, (3) the ability to publish research analysis results, (4) the ability to analyze research results correctly.
Laboratory Practitioner (industry and education)	Graduates of the Chemistry Study Program are equipped with reliable abilities and skills to work as laboratory testers. These abilities and skills include: (1) the ability to carry out supervisory activities in laboratory work, (2) utilizing chemistry to solve problems and being able to adapt to technological changes, (3) mastery of chemical testing, (4) instrument usage skills, (5) mastery of analytical skills and selection of appropriate testing methods and procedures, (6) data processing and analysis, and (7) implementation of occupational safety, health, and environmental management.
Trainer in the field of chemistry	Graduates of the Chemistry Study Program, equipped with additional skills in chemistry education, can become trainers or communicators in the field of chemistry who are able to transfer chemical knowledge and skills to individuals or groups, whether in academic, industrial, or general community settings.
Entrepreneur or practitioner	Graduates of the Chemistry Study Program with expertise in chemistry can develop themselves into entrepreneurs or practitioners. Additional skills such as managerial, accounting, and entrepreneurial practices will support a career in entrepreneurship.

2. Alignment of Graduate Profile with Study Program Objectives

The alignment of the graduate profile with the study program objectives is presented in Table 8.

Table 8. Alignment of Graduate Profile with UNY Chemistry Study Program Objectives

Graduate Profile	PO 1	PO 2	PO 3
Chemical Analyst	√	√	√
Research assistants in the field of chemistry in industry, formal and informal institutions	√	√	√
Laboratory Practitioner (industry and education)	√	√	√
Trainer in the field of chemistry	√	√	√
Entrepreneur or practitioner	√	√	√

F. Program Learning Outcomes

1. Formulation of Learning Outcomes

The Learning Outcomes (CPL) of the Chemistry Undergraduate Program, Faculty of Mathematics and Natural Sciences, Yogyakarta State University are presented in Table 9.

Table 9. PLOs of the Chemistry Undergraduate Program

No	PLO Formulation
PLO-1	Possess religious, nationalistic, humanistic attitudes, and be responsible in completing tasks independently as lifelong learners
PLO-2	Master theoretical concepts regarding the structure, properties, functions, changes, energy and dynamics, identification, separation, characterization, transformation, and synthesis of micromolecular chemical substances and their applications

No	PLO Formulation
PLO-3	Master operational knowledge of the functions and operation of chemical instruments, as well as data and information analysis from these instruments
PLO-4	Master the basic principles of software for analysis, synthesis, and molecular modeling in general or more specific fields of chemistry
PLO-5	Able to assess and utilize science and technology in the field of chemistry and compile the results in a report through logical, creative, critical, systematic, and innovative thinking
PLO-6	Possess leadership responsibility and decision-making skills in project completion with mastery of information technology and sustainability principles as well as an understanding of technology-based entrepreneurship.
PLO-7	Able to carry out experiments, analyze data, and interpret results by integrating mathematical and scientific concepts in problem solving in the field of chemistry
PLO-8	Able to solve science and technology problems in the field of chemistry by applying relevant and environmentally friendly methods and technologies
PLO-9	Able to use software to process and analyze chemical experiment data and utilize Big Data, Internet of Things (IoT), Artificial Intelligence (AI) for problem solving in the field of chemistry

2. Alignment of PLOs with POs

The alignment of PLOs with Program Objectives is presented in Table 10.

Table 10. Alignment between PLOs and Program Objectives

Program Learning Outcomes	PO 1	PO 2	PO 3
PLO1: Possess religious, nationalistic, humanistic attitudes, and be responsible in completing tasks independently as lifelong learners		√	√
PLO2: Master theoretical concepts regarding the structure, properties, functions, changes, energy and dynamics, identification, separation, characterization, transformation, and synthesis of micromolecular chemical substances and their applications	√		√
PLO3: Master operational knowledge of the functions and operation of chemical instruments, as well as data and information analysis from these instruments	√		√
PLO4: Master the basic principles of software for analysis, synthesis, and molecular modeling in general or more specific fields of chemistry	√	√	
PLO5: Able to assess and utilize science and technology in the field of chemistry and compile the results in a report through logical, creative, critical, systematic, and innovative thinking	√	√	√
PLO6: Possess leadership responsibility and decision-making skills in project completion with mastery of information technology and sustainability principles as well as an understanding of technology-based entrepreneurship..	√	√	√
PLO7: Able to carry out experiments, analyze data, and interpret results by integrating mathematical and scientific concepts in problem solving in the field of chemistry	√		√
PLO8: Able to solve science and technology problems in the field of chemistry by applying relevant and environmentally friendly methods and technologies	√	√	√
PLO9: Able to use software to process and analyze chemical experiment data and utilize Big Data, Internet of Things (IoT), Artificial Intelligence (AI) for problem solving in the field of chemistry	√		√

3. Alignment of Graduate Learning Outcomes with Graduate Profile
   The alignment of CPL with graduate profiles is presented in Table 11.

Table 11. Table of Compatibility between Graduate Learning Outcomes and Graduate Profile

Graduate Profile	PLO									
	1	2	3	4	5	6	7	8	9	10
Chemical Analyst	√	√	√	√	√	√	√	√	√	√
Research Assistant	√	√	√	√	√	√	√	√	√	√
Laboratory Practitioner	√	√	√	√	√	√	√	√	√	√
Trainer in the field of chemistry	√	√	√	√	√	√	√	√	√	√
Entrepreneur or practitioner	√	√	√	√	√	√	√	√	√	√

G. Study Materials and Courses

The alignment of CPLs, study materials, and courses is presented in Table 12, while the matrix of CPL and course relationships and the determination of credit hours is presented in Table 13.

Table 12. Suitability of Graduate Learning Outcomes, Study Materials, and Courses

PLO	Study Materials										
	SM1	SM2	SM3	SM4	SM5	SM6	SM7	SM8	SM9	SM10	SM11
PLO 1	MWK60201-60209										
PLO 2			SKM60401, 60404, 60301, 60206, 60409, 60211, 60215, 60219- 60224, 60247- 60248, MLK60602, MKK60801	SKM60401, 60403, 60408, 60207, 60304, 60215, 60224, 60229-60237, 60239, 60241 60248, MLK60602, MKK60301, MKK60801	SKM60401, 60402, 60406, 60212, 60215, 60224, 60225, 60238, 60242, 60247-60249, MLK60602, MKK60301, MKK60801	SKM60401, 60407, 60209, 60239, 60241 MLK60602, MKK60301, 60801	SKM60405, 60226, 60242, 60246, 60247, 60249, MLK60602, MKK60410, 60801				
PLO 3			SKM60401, 60404, 60301, 60409, 60214, 60217, MLK60602, MKK60801	SKM60401,MK15, MK19, MK27, MK34, MLK60602, MK75	SKM60401, 60402, 60406, MLK60602, MKK60301, 60801	SKM60401, 60407, MLK60602, MKK60301, 60801					
PLO 4									MLK60602, MKK60301, MKK60801		
PLO 5								SKM60401-60407, 60215, 60301-60304, MLK60602, MKK60301, 60801			
PLO 6											SKM60204, MLK60602, 60605, MKK60301, 60801
PLO 7		FMI60201-60202, SKM60201-60203,60209, 60401-60407, 60304,	SKM60401, 60404, 60301, 60409, MLK60602, MKK60801	SKM60401,MK15, MK19, MK27, MLK60602, MKK60801	SKM60401, 60402, 60406, MKK60801	SKM60401, 60407, MLK60602, MKK60801					

PLO	Study Materials										
	SM1	SM2	SM3	SM4	SM5	SM6	SM7	SM8	SM9	SM10	SM11
		MLK60602, MKK60801									
PLO 8										SKM60204, 60207 60208, 60216, 60219, 60221-60223, 60225-60226, 60228-60229, 60231, 60235, 60240, 60241, 60245, SKM60305, MLK60602, 60605, MKK60301, 60801	
PLO 9		SKM60250									SKM60204, SKM60214-60215, 60219 60306, MLK60602, 60605, MKK60301, 60801

SM1:	Religion, character, education, and social humanities	Covers religious concepts, character/attitude (Pancasila, citizenship, ethics), and social humanities interactions (communication skills, collaboration, and self-development)
SM2:	Mathematics and Science	Covers the material, structure, mindset, and concepts of mathematics (calculus, variables, matrices) and science (physics, biology, earth science) as the basic foundation of chemistry
SM3:	Inorganic Chemistry	Covers the study of the structure, properties, and reactivity of inorganic compounds, as well as the elements that compose them. This field of science also studies chemical reactions involving these compounds, including redox and acid-base reactions, as well as the application of inorganic compounds in various fields such as industry and materials
SM4:	Organic Chemistry	Covers the study of the structure, properties, reactions, and synthesis of carbon compounds.
SM5:	Physical Chemistry	It covers basic concepts and theories about the physicochemical properties of substances, including the state of matter, solutions, equilibrium, thermodynamics, and kinetics.
SM6:	Biochemistry	It covers the chemical processes that occur in living organisms, combining the principles of chemistry and biology to understand the structure, function, and interaction of molecules in living organisms, including bioenergetics.
SM7:	Separation and Purification	Master and understand the material, concepts of separation and purification in terms of factors such as temperature, solubility, polarity (molecular and electrical), and size/mass
SM8	Measurement and Identification	Mastering and understanding the concepts of measurement, analysis, and identification of materials
SM9	Synthesis	Mastering and understanding the material and concepts of organic and inorganic material synthesis

SM10	Green Chemistry	Mastering and understanding the material and concepts of environmentally-conscious chemistry
SM11	Applied Chemistry	Mastering and understanding the application of basic chemistry concepts in other fields, such as the environment, energy, food, materials, forensics, and others.

Table 13. Matrix of PLO and Course Relationships and Determination of Credit Hours

No MK	Code	Course Name	PLO									Time Estimation (min)	UCTS	ECTS
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9			
1	MWK60201	Islamic Education*	√									5400	2	3.2
	MWK60202	Catholic Education*	√									5400	2	3.2
	MWK60203	Christianity Education*	√									5400	2	3.2
	MWK60204	Hinduism Education*	√									5400	2	3.2
	MWK60205	Buddhism Education*	√									5400	2	3.2
	MWK60206	Confucianism Education*	√									5400	2	3.2
2	MWK60207	Civics Education	√									5400	2	3.2
3	MWK60208	Pancasila	√									5400	2	3.2
4	MWK60209	Bahasa Indonesia	√									5400	2	3.2
5	MWU60201	English for Specific Purpose	√									5400	2	3.2
6	MWU60202	Sports and Physical Fitness	√									5400	2	3.2
7	MWU60203	Sustainable and Education Development	√									5400	2	3.2
8	FMI60201	Perspectives and Studies of Mathematics and Natural Sciences							√			5400	2	3.2
9	FMI60202	Statistics							√			5400	2	3.2
10	SKM60201	Mathematics for Chemistry							√			5400	2	3.2
11	SKM60202	Physiscs for Chemistry							√			5400	2	3.2
12	SKM60203	Biology for Chemistry							√			5400	2	3.2
13	SKM60204	Environmental Chemistry						√		√	√	5400	2	3.2
14	SKM60205	Fundamental of Computational Chemistry				√					√	5400	2	3.2
15	SKM60206	Quantum Chemistry		√		√						5400	2	3.2
16	SKM60207	Physical Organic Chemistry		√						√		5400	2	3.2
17	SKM60208	Chemical Laboratory Management			√					√		5400	2	3.2
18	SKM60209	Advanced Biochemistry		√						√		5400	3	3.2
19	SKM60210	Surface Chemistry					√			√		5400	2	3.2
20	SKM60211	Mechanism of Inorganic Reaction		√		√						5400	2	3.2
21	SKM60212	Atomic and Molecular Spectroscopy		√		√						5400	2	3.2
22	SKM60213	Elucidation of Organic Compound Structures			√	√						5400	2	3.2

No MK	Code	Course Name	PLO									Time Estimation (min)	UCTS	ECTS
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9			
23	SKM60214	Elucidation of Inorganic Compound Structures			√	√					√	5400	2	3.2
24	SKM60215	Selected Topics in Chemical Research		√			√				√	5400	2	3.2
25	SKM60216	Polymer Chemistry					√			√		5400	2	3.2
26	SKM60217	Nuclear Chemistry			√		√					5400	2	3.2
27	SKM60218	Advanced Computational Chemistry				√				√	√	5400	2	3.2
28	SKM60219	Chemical Applications of Group Theory		√						√	√	5400	2	3.2
29	SKM60220	Inorganic Chemical Synthesis		√						√		5400	2	3.2
30	SKM60221	Crystallograpgy and Solid State Inorganic Chemistry		√						√	√	5400	2	3.2
31	SKM60222	Nanochemistry Technology		√						√		5400	2	3.2
32	SKM60223	Bioinorganic Chemistry		√						√		5400	2	3.2
33	SKM60224	Material Chemistry		√						√		5400	2	3.2
34	SKM60225	Membrane Technology		√						√		5400	2	3.2
35	SKM60226	Catalyst Chemistry		√						√		5400	2	3.2
35	SKM60227	Geochemistry				√				√		5400	2	3.2
37	SKM60228	Pharmaceutical Chemistry		√						√		5400	2	3.2
38	SKM60229	Molecular Biothecnology		√						√		5400	2	3.2
39	SKM60230	Food Chemistry		√						√		5400	2	3.2
40	SKM60231	Synthetic Organic Chemistry		√						√		5400	2	3.2
41	SKM60232	Cosmetics Chemistry		√						√		5400	2	3.2
42	SKM60233	Forensic Chemistry		√						√		5400	2	3.2
43	SKM60234	Isolation anf Identification of Natural Compound		√						√		5400	2	3.2
44	SKM60235	Reaction Mechanism of Organic Compound		√						√		5400	2	3.2
45	SKM60236	Toxycology*		√						√		5400	2	3.2
46	SKM60237	Enzymology		√						√		5400	2	3.2
47	SKM60238	Petroleum Chemistry and Energy*		√						√		5400	2	3.2
48	SKM60239	Fermentation Technology		√						√		5400	2	3.2
49	SKM60240	Medicinal Chemistry		√						√		5400	2	3.2
50	SKM60241	Physiscal Biochemistry		√						√		5400	2	3.2
51	SKM60242	Analytical Electrochemistry		√						√		5400	2	3.2
52	SKM60243	Corrosion and Electroplating Chemistry		√						√		5400	2	3.2
53	SKM60244	Radioanalysis		√						√		5400	2	3.2

No MK	Code	Course Name	PLO									Time Estimation (min)	UCTS	ECTS
			PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9			
54	SKM60245	Management of Hazardous and Toxic Waste		√						√		5400	2	3.2
55	SKM60246	Coloid and Surfactant		√						√		5400	2	3.2
56	SKM60247	Industrial Materials Analysis		√						√		5400	2	3.2
57	SKM60248	Industrial Chemistry		√						√		5400	2	3.2
58	SKM60249	Industrial Management				√		√				5400	2	3.2
59	SKM60250	Data Science and Chemical Programing				√	√	√		√	√	5400	2	3.2
60	SKM60301	Basic of Inorganic Reaction		√	√		√		√			8200	3	4.8
61	SKM60302	Chemical Separation Method		√	√		√		√			8200	3	4.8
62	SKM60303	Chemistry Enterpreneurhip	√				√	√		√	√	8200	3	4.8
63	SKM60401	Fundamental Chemistry		√	√		√	√	√			10800	4	6.4
64	SKM60402	Chemical Equilibrium		√	√		√		√			10800	4	6.4
65	SKM60403	Fundamental of Organic Chemistry		√	√		√		√			10800	4	6.4
66	SKM60404	Fundamental of Inorganic Chemistry		√	√		√		√			10800	4	6.4
67	SKM60405	Fundamental of Analytical Chemistry		√	√		√		√			10800	4	6.4
68	SKM60406	Molecular Dynamics		√	√		√		√			10800	4	6.4
69	SKM60407	Biochemistry		√	√		√		√			10800	4	6.4
70	SKM60408	Structure of Polifunctional Organic Compound		√	√		√		√			10800	4	6.4
71	SKM60409	Coordination Chemistry and Organometal		√	√		√		√			10800	4	6.4
72	SKM60410	Chemical Instrumentation			√	√	√		√			10800	4	6.4
73	MLK60602	Field Work Practice		√	√	√	√	√	√	√	√	16200	6	9.6
74	MLK60605	Community Services	√			√	√	√		√	√	16200	6	9.6
75	MKK60301	Research Methodology		√	√	√	√	√		√	√	8200	3	4.8
76	MKK60801	Thesis	√	√	√	√	√	√	√	√	√	21600	8	12.8

Example of UCTS calculation:
Basic Inorganic Chemistry course
Theory: Lectures 120 hours/16 weeks = 7.5 hours x 60 minutes/week = 450 hours/week divided by 160 SKS = 2.81 UCTS theory
Practical: 48 hours/16 weeks = 1 credit hour Total = (3+1) credit hours = 4 credit hours

H. Curriculum Structure and Course Distribution

The curriculum structure of the Chemistry study program consists of scientific foundation courses, expertise courses, concentration elective courses, prerequisite courses, additional courses, and so on. The curriculum structure of the Chemistry study program refers to the UNY 2025 Curriculum Guidelines (Table 14). The distribution of courses and the number of credits for the Chemistry undergraduate program are shown in Tables 15 to 23.

Tabel 14. Struktur Kurikulum Prodi Sarjana Kimia

No	Course	Minimum UCTS
1.	Compulsory Curriculum Courses (MKWK)	8
2.	Compulsory University Courses (MKWU)	6
3.	Faculty Courses (MKF)	4
4.	Required Program Foundation Courses (MKPKP)	76
5	Elective Program Foundation Courses (MKPKP)	24-40
6.	Out-Campus Learning Courses (MKPLK)	12
7.	Academic Development Courses (MKPK)	11
8.	Additional Competency Courses (MKTK)	3
Total UCTS		144-160

Table 15. Compulsory Curriculum Courses (MKWK)

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	J	Gs	Gn	
1	MWK60201	Islamic Education*	2	-	-	2	1		-
	MWK60202	Catholic Education*							
	MWK60203	Christianity Education*							
	MWK60204	Hinduism Education*							
	MWK60205	Buddhism Education*							
	MWK60206	Confucianism Education*							
2	MWK60207	Civics Education	2	-	-	2	1		
3	MWK60208	Pancasila	2	-	-	2		2	-
4	MWK60209	Bahasa Indonesia	2	-	-	2		4	-
Total UCTS						8			

*based on student's religion

Table 16. Compulsory University Courses (MKWU)

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	J	Gs	Gn	
1	MWU60201	English for Specific Purpose	2	-	-	2	1		
2	MWU60202	Sports and Physical Fitness	1	1	-	2		4	
3	MWU60203	Sustainable and Education Development	2	-	-	2	1		
Total UCTS						6			

Tabel 17. Faculty Course

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	J	Gs	Gn	
1	FMI60201	Perspectives and Studies of Mathematics and Natural Sciences	2	-	-	2	1		
2	FMI60202	Statistics	2	-	-	2		2	
Total						4			

Tabel 18. Required Program Foundation Courses (MKPKP)

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	J	Gs	Gn	
1	SKM60201	Mathematics for Chemistry	2	-	-	2	1		
2	SKM60202	Physiscs for Chemistry	2	-	-	2	1		
3	SKM60203	Biology for Chemistry	2	-	-	2	1		
4	SKM60401	Fundamental Chemistry	3	1	-	4	1		-
5	SKM60402	Chemical Equilibrium	3	1	-	4		2	SKM60401
6	SKM60403	Fundamental of Organic Chemistry	3	1	-	4		2	SKM60401
7	SKM60404	Fundamental of Inorganic Chemistry	3	1	-	4		2	SKM60401
8	SKM60405	Fundamental of Analytical Chemistry	3	1	-	4		2	SKM60401
9	SKM60204	Environmental Chemistry	2	-	-	2	3		
10	SKM60205	Fundamental of Computational Chemistry	1	1	-	2	3		
11	SKM60301	Basic of Inorganic Reaction	2	1	-	3	3		SKM60401
12	SKM60302	Chemical Separation Method	2	1	-	3	3		SKM60401
13	SKM60406	Molecular Dynamics	3	1	-	4	3		SKM60401
14	SKM60407	Biochemistry	2	2	-	4	3		SKM60403
15	SKM60408	Structure of Polifunctional Organic Compound	2	2	-	4	3		SKM60401
16	SKM60206	Quantum Chemistry	2	-	-	2		4	
17	SKM60207	Physical Organic Chemistry	2	-	-	2		4	
18	SKM60208	Chemical Laboratory Management	2	-	-	2		4	
19	SKM60209	Advanced Biochemistry	2	-	-	2		4	SKM60403
20	SKM60210	Surface Chemistry	2	-	-	2		4	
21	SKM60409	Coordination Chemistry and Organometal	3	1	-	4		4	
22	SKM60410	Chemical Instrumentation	2	2	-	4		4	
23	SKM60211	Mechanism of Inorganic Reaction	2	-	-	2	5		SKM60404
24	SKM60212	Atomic and Molecular Spectroscopy	2	-	-	2	5		
25	SKM60213	Elucidation of Organic Compound Structures	2	-	-	2	5		
26	SKM60214	Elucidation of Inorganic Compound Structures	2	-	-	2	5		
27	SKM60215	Selected Topics in Chemical Research	2	-	-	2	5		
Total			60	16		76			

Table 19. Elective Program Foundation Courses (MKPKP)

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	**J**	**Gs**	**Gn**	
Specialization in Renewable and Functional Materials Chemistry									
1	SKM60216	Polymer Chemistry	2	-	-	2	√		SKM60401
2	SKM60217	Nuclear Chemistry	2	-	-	2	√		
3	SKM60218	Advanced Computational Chemistry	2	-	-	2		√	SKM60205
4	SKM60219	Chemical Applications of Group Theory	2	-	-	2		√	
5	SKM60220	Inorganic Chemical Synthesis	2	-	-	2	√		SKM60401

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	**J**	**Gs**	**Gn**	
6	SKM60221	Crystallograpgy and Solid State Inorganic Chemistry	2	-	-	2		√	SKM60401
7	SKM60222	Nanochemistry Technology	2	-	-	2	√		SKM60401
8	SKM60223	Bioinorganic Chemistry	2	-	-	2		√	SKM60401
9	SKM60224	Material Chemistry	2	-	-	2	√		SKM60401
10	SKM60225	Membrane Technology	2	-	-	2	√		SKM60401
11	SKM60226	Catalyst Chemistry	2	-	-	2		√	SKM60401
12	SKM60227	Geochemistry	2	-	-	2		√	SKM60401
Biochemistry Specialization									
13	SKM60228	Pharmaceutical Chemistry	2	-	-	2	√		SKM60403
14	SKM60229	Molecular Biothecnology	2	-	-	2		√	SKM60403
15	SKM60230	Food Chemistry	2	-	-	2	√		SKM60403
16	SKM60231	Synthetic Organic Chemistry	2	-	-	2		√	SKM60403
17	SKM60232	Cosmetics Chemistry	2	-	-	2	√		SKM60403
18	SKM60233	Forensic Chemistry	2	-	-	2		√	SKM60403
19	SKM60234	Isolation anf Identification of Natural Compound	2	-	-	2	√		SKM60403
20	SKM60235	Reaction Mechanism of Organic Compound	2	-	-	2		√	SKM60403
21	SKM60236	Toxycology*	2	-	-	2	√		SKM60407
22	SKM60237	Enzymology	2	-	-	2		√	SKM60403
23	SKM60238	Petroleum Chemistry and Energy*	2	-	-	2	√		
24	SKM60239	Fermentation Technology	2	-	-	2	√		SKM60403
25	SKM60240	Medicinal Chemistry	2	-	-	2		√	
26	SKM60241	Physiscal Biochemistry	2	-	-	2		√	
Peminatan Kimia Ramah Lingkungan									
27	SKM60242	Analytical Electrochemistry	2	-	-	2	√		
28	SKM60243	Corrosion and Electroplating Chemistry	2	-	-	2	√		
29	SKM60244	Radioanalysis	2	-	-	2		√	
30	SKM60245	Management of Hazardous and Toxic Waste	2	-	-	2	√		
31	SKM60246	Coloid and Surfactant	2	-	-	2		√	
Peminatan Kimia Industri									
32	SKM60247	Industrial Materials Analysis	2	-	-	2	√		
33	SKM60248	Industrial Chemistry	2	-	-	2		√	
34	SKM60249	Industrial Management*	2	-	-	2	√		
35	SKM60250	Data Science and Chemical Programing	2	-	-	2		√	

Keterangan: * dapat diambil mulai semester 3 ketika memenuhi

Tabel 20. Mata Kuliah Pembelajaran Luar Kampus

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	J	Gs	Gn	
1	MLK60602	Field Work Practice	-	-	6	6	7		
2	MLK60605	Community Services	-	-	6	6	7		
Jumlah						12			

Table 21. Scientific Development Course

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	J	Gs	Gn	
1	MKK60301	Research Methodology	3	-	-	3		6	SKM60214
2	MKK60801	Undergraduate Thesis	-	8	-	8		8	MKK60301
Jumlah						11			

Table 22. Competency-based Elective Courses (MKTK)

No	Code	Course	UCTS				Semester		Prerequisites
			T	P	L	J	Gs	Gn	
1	SKM60303	Chemistry Enterpreneurship	2	1	-	3		6	-
Total						3			

Table 13. Course Distribution Each Semester

Code	Mata Kuliah	Course	SKS				Category
			T	P	L	J	
Semester 1							
MWK60201	Pendidikan Agama Islam	Islamic Education	2*	-	-	2*	Compulsory*
MWK60202	Pendidikan Agama Katolik	Catholic Education	2*	-	-	2*	Compulsory*
MWK60203	Pendidikan Agama Kristen Protestan	Christianity Education	2*	-	-	2*	Compulsory*
MWK60204	Pendidikan Agama Hindu	Hinduism Education	2*	-	-	2*	Compulsory*
MWK60205	Pendidikan Agama Budha	Buddhism Education	2*	-	-	2*	Compulsory*
MWK60206	Pendidikan Agama Konghucu	Confucianism Education	2*	-	-	2*	Compulsory*
MWK60207	Pendidikan Kewarganegaraan	Civic Education	2	-	-	2	Compulsory
MWU60201	Bahasa Inggris Tujuan Khusus	English for Specific Purposes	2	-	-	2	Compulsory
MWU60203	Pendidikan dan Pembangunan Berkelanjutan	Education and Sustainable Development	2	-	-	2	Compulsory
FMI60201	Wawasan dan Kajian MIPA	Perspectives and Studies of Mathematics and Natural Sciences	2	-	-	2	Compulsory
SKM60201	Matematika untuk Kimia	Mathematics for Chemistry	2	-	-	2	Compulsory
SKM60202	Fisika untuk Kimia	Physics for Chemistry	2	-	-	2	Compulsory
SKM60203	Biologi untuk Kimia	Biology for Chemistry	2	-	-	2	Compulsory
SKM60401	Kimia Dasar	Fundamental Chemistry	3	1	-	4	Compulsory
Jumlah			**19**	**1**	**-**	**20**	

Semester 2							
MWK60208	Pancasila	Pancasila	2	-	-	2	Compulsory
FMI60202	Statistika Dasar	Basic Statistics	2	-	-	2	Compulsory
SKM60402	Kesetimbangan Kimia	Chemical Equilibrium	3	1	-	4	Compulsory
SKM60403	Kimia Organik Dasar	Basic Organic Chemistry	3	1	-	4	Compulsory

SKM60404	Kimia Anorganik Dasar	Fundamental of Inorganic Chemistry	3	1	-	4	Compulsory
SKM60405	Dasar-dasar Kimia Analitik	Fundamentals of Analytical Chemistry	3	1	-	4	Compulsory
Jumlah			**16**	**4**	**-**	**20**	
Semester 3							
SKM60204	Kimia Lingkungan	Environmental Chemistry	2	-	-	2	Compulsory
SKM60205	Dasar-dasar Kimia Komputasi	Fundamentals of Computational Chemistry	1	1	-	2	Compulsory
SKM60301	Dasar Reaksi Anorganik	Basic Inorganic Reactions	2	1	-	3	Compulsory
SKM60302	Metode Pemisahan Kimia	Chemical Separation Method	2	1	-	3	Compulsory
SKM60406	Dinamika Molekuler	Molecular Dynamics	3	1	-	4	Compulsory
SKM60407	Biokimia	Biochemistry	2	2	-	4	Compulsory
SKM60408	Struktur Senyawa Organik Polifungsional	Structure of Polyfunctional Organic Compounds	2	2	-	4	Compulsory
Total			**14**	**8**	**-**	**22**	

Semester 4							
MWK60209	Bahasa Indonesia	Bahasa Indonesia	2	-	-	2	Compulsory
MWU60202	Olahraga dan Kebugaran Jasmani	Sports and physical fitness	1	1	-	2	Compulsory
SKM60206	Kimia Kuantum	Quantum Chemistry	2	-	-	2	Compulsory
SKM60207	Kimia Organik Fisik	Physical Organic Chemistry	2	-	-	2	Compulsory
SKM60208	Pengelolaan Laboratorium Kimia	Chemical Laboratory Management	2	-	-	2	Compulsory
SKM60209	Biokimia Lanjut	Advanced Biochemistry	2	-	-	2	Compulsory
SKM60210	Kimia Permukaan	Surface Chemistry	2	-	-	2	Compulsory
SKM60409	Kimia Koordinasi dan Organologam	Coordination and Organometallic Chemistry	3	1	-	4	Compulsory
SKM60410	Instrumentasi Kimia	Chemical Instrumentation	2	2	-	4	Compulsory
Total			**17**	**4**	**-**	**22**	

Semester 5							
SKM60211	Mekanisme Reaksi Anorganik	Inorganic Reaction Mechanisms	2	-	-	2	Compulsory
SKM60212	Spektroskopi Atomik dan Molekuler	Atomic and Molecular Spectroscopy	2	-	-	2	Compulsory

SKM60213	Elusidasi Struktur Senyawa Organik	Structure Elucidation of Organic Compounds	2	-	-	2	Compulsory
SKM60214	Elusidasi Struktur Senyawa Anorganik	Structure Elucidation of Inorganic Compounds	2	-	-	2	Compulsory
SKM60215	Topik-topik Penelitian Kimia	Chemical Research Topics	2	-	-	2	Compulsory
	Mata Kuliah Peminatan	Elective courses	12			12	Elective
Total			**22**	**-**	**-**	**22**	
Semester 6							
MKK60301	Metodologi Penelitian Kimia	Chemistry Research Methodology	3	-	-	3	Compulsory
SKM60303	KWU Kimia	Chemistry Enterpreneurship	2	1	-	3	Compulsory
	Mata Kuliah Peminatan	Elective courses	12	-	-	12	Elective
Total			**17**	**1**		**18**	

Semester 7							
MLK60602	Praktek Kerja Lapangan (PKL)	Field Work Practice	-	-	6	6	Wajib
MLK60605	Kuliah Kerja Nyata (KKN)	Community Services	-	-	6	6	Wajib
Total			**-**	**-**	**12**	**12**	

Semester 8							
MKK60801	Tugas Akhir Skripsi	Undergraduate Thesis	-	8	-	8	Wajib
Total			**-**	**8**	**-**	**8**	

I. Learning Process

The learning process in the Chemistry Study Program is designed to deliver optimal outcomes. Lecturers and program administrators are required to have a solid understanding of the importance of didactic methods and instruments to achieve effective learning results. Prior to assuming their teaching responsibilities, lecturers in the study program are provided with *applied approach* training, ensuring that both the content and the teaching method, model, or approach selected are appropriate and effective. Additional refresher courses are also available through methodology training organized by the Institute of Quality Assurance and Educational Development, when necessary. Training on online teaching has also been conducted, including the use of Be Smart, Google Classroom, Zoom, Google Meet, and other applications.

The role of lecturers in the learning process includes curriculum design, establishing teaching teams, developing learning contracts, lesson plans, assessment systems, and classroom activities. A teaching team consists of lecturers with similar expertise. Each course is designed with specific Course Learning Outcomes (CLOs), which

serve as derivatives of the Program Learning Outcomes (PLOs). Each PLO is composed of one or more CLOs, with the assessment carried out by the teaching team through examinations, such as the Mid-Semester Examination and the Final Examination.

The learning approach applied emphasizes **Student-Centered Learning (SCL)**. Examples of learning models that implement SCL include group discussion, problem-based learning, and project-based learning. These methods have proven effective in encouraging students to take an active role in the learning process, thereby producing graduates who are more competitive in the global era.

Independent scientific writing by students is supported through the *Research Methodology in Chemistry* course. This course guides students in conducting chemical research, preparing undergraduate theses, and publishing their work in indexed scientific journals or conference proceedings. The expected outputs of this course are research proposals and draft scientific articles ready for submission.

The learning process can be monitored at any time by the Study Program Coordinator through **siakad2013.uny.ac.id**, and evaluated at the beginning and end of each semester by students. Students are directly involved in monitoring and evaluating each course by completing online course evaluation questionnaires at the start and end of every semester through **http://emonev.lppmp.uny.ac.id/**. The results of this monitoring are provided to the respective lecturers as feedback for improving teaching quality. The outcomes are also discussed in faculty plenary meetings at the end of each semester, with attention given to the highest and lowest evaluation scores to motivate lecturers in improving their teaching practices.

UNY supports the success of the learning process and learning outcomes to ensure that students graduate on time with high achievement by providing various facilities, including laboratories, libraries, e-learning platforms, academic guidance, career counseling, and other facilities. The Chemistry Study Program's information system has also advanced significantly, particularly due to UNY's implementation of the Single Sign-On (SSO) system, which allows staff and students to access all online facilities with a single login.

Effective consultation and mentoring are offered through academic advising. Each new student is assigned an academic advisor who provides guidance on academic issues that students may find difficult to resolve independently. Academic advisors assist in finding solutions and, when necessary, coordinate with the study program to involve other relevant parties who may be able to help.

The Chemistry Study Program also provides a broad range of student support, including academic advising, counseling services, scholarship guidance, career guidance, extracurricular and talent development, as well as religious mentoring. These services are designed to help students shorten their study period and enhance their academic achievements. For students undertaking the undergraduate thesis (*Tugas Akhir Skripsi*), supervision is provided by a lecturer with a minimum functional rank of *Lektor* (Assistant Professor). Supervisors guide students in completing their research projects and monitor progress through thesis supervision records, ensuring timely completion. Thesis supervision can also be conducted online via **http://bimbingan.uny.ac.id/**, enabling flexible consultation between students and their supervisors. This facility supports students in completing their studies on time.

The Chemistry Study Program at the Faculty of Mathematics and Natural Sciences (FMIPA) UNY is equipped with comprehensive laboratory facilities, including laboratories

for Basic Chemistry, Organic and Biochemistry, Physical and Inorganic Chemistry, and Analytical Chemistry to support practicum-based learning. Separate research laboratories are also available, along with an integrated laboratory housing advanced chemical instruments for sample analysis. Furthermore, a computer laboratory equipped with 44 computers connected via Local Area Network (LAN) provides access to computer-assisted chemistry applications, computational chemistry, teaching material development, data analysis for chemical education research, as well as access to global information through the internet and e-library. These facilities are expected to enhance the quality of student learning and ensure timely completion of studies.

J. Assesment

Learning assessment is an essential component of the curriculum to evaluate students' achievement of the intended learning outcomes. In accordance with the Ministry of Education, Culture, Research, and Technology Regulation (Permendikbudristek) No. 53 of 2023 on Quality Assurance in Higher Education regarding assessment standards, the Undergraduate Chemistry Study Program implements the assessment process based on the principles of being educative, authentic, objective, accountable, and transparent. Assessment comprises two main aspects: **process assessment** and **learning outcome assessment**. Process assessment aims to capture how students engage in the learning process, including personality and character aspects, while outcome assessment evaluates the attainment of competencies (fulfillment of Program Learning

Outcomes/PLOs) after completing the learning process. **Process assessment** is used to measure student involvement in learning activities, particularly soft skills such as participation, ability to articulate ideas, sense of responsibility and independence, solidarity and teamwork, and motivation. This assessment is carried out through observation, peer evaluation, and portfolios, and contributes to the determination of the final grade.

Outcome assessment evaluates students' ability to achieve competencies as stated in the Course Learning Outcomes (CLOs). This is conducted through competency tests for each sub-CLO, midterm examinations, practical exams, and final examinations. Methods used include written tests, essays/papers, oral examinations, practical tests, and portfolios. Various assessment techniques may be employed, such as observation, participation, performance, written tests, oral tests, and questionnaires. Instruments for assessing the learning process include rubrics and portfolios, while outcome assessment integrates multiple techniques and instruments.

Measurement and assessment are expected to cover all domains of learning in each course—knowledge, attitudes, and skills. Assessments are conducted through both test and non-test methods to ensure authenticity and relevance to the intended learning outcomes. Non-test assessments may include the **4Ps**: Performance, Product, Project, and Portfolio. In line with the National Standards for Higher Education (SN-Dikti), assessments at all levels must consider validity, reliability, comprehensiveness, character-building, and sustainability.

Assessment results are reported as student achievement qualifications for each course, expressed in numerical and letter grades according to prevailing academic regulations. Students with high academic achievement are those who attain a semester GPA (Grade Point Average) above 3.50 and uphold academic ethics

Notes :

PLO assessment is conducted using an *Outcome-Based Assessment (OBA)* approach to ensure every student achieves the required competencies.

- PLOs are not directly assessed but are measured through CLOs (Course Learning Outcomes) that are more specific.
- Each course must have CLOs that contribute to particular PLOs.
- Each CLO must have measurable assessments relevant to the related PLO.
- Assessment forms should vary according to the level of competency (attitudes, knowledge, general skills, specific skills).
- Cumulative evaluation is conducted after students complete all courses related to a given PLO.

Methods Used

1. **Student Portfolio** → Assessing student achievement through assignments, projects, and reports completed during their studies.
2. **Capstone Competency (Capstone Project, Undergraduate Thesis, or Comprehensive Examination)** → Students complete a major project that reflects mastery of the PLOs.
3. **Tracer Study and Employer/User Satisfaction Surveys** → Evaluating the attainment of PLOs after graduation by involving industry and academic stakeholders.
4. **PLO Scoring** → Converting students' achievements in relevant courses into measurable indicators of graduate learning outcomes.

$$\text{Skor CPL} = \sum_{i=6}^{i} \frac{Nilai\ x\ \%CPL}{\Sigma Bobot\ kontribusi}$$

Table 24. Contribution Weight of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs)

Course	PLO	CPMK	Kognitif					Participatory		PLO (%)	Contribution Weight
			Attendance (%)	Quiz (%)	Assignments(%)	MidtermExam (%)	Final Exam (%)	Case Study (%)	Team Based Project (%)		
MK16*	CPL-2	CPMK01								50	100
		CPMK02		5		5			20		
		CPMK03									
		CPMK04			5	5					
		CPMK05				5	5				
	CPL-3	CPMK01			5					10	
		CPMK04					5				
	CPL-5	CPMK06	5					10		15	
	CPL-7	CPMK02						10		25	
		CPMK06					5		10		
	Total		5	5		15	15	20	30	100	

*MK16 : Kimia Anorganik Dasar

CPMK-01	Able to explain the concepts of atomic structure, orbitals, periodic properties of elements, and element reactivity.	PLO-2 PLO-3
CPMK-02	Able to explain molecular structures, theories of bond formation, and molecular geometry structures	PLO-2 PLO-7
CPMK-03	Able to explain the concept of acids and bases	PLO-2
CPMK-04	Able to analyze chemical reactions, particularly redox reactions.	PLO-2 CPL-3
CPMK-05	Able to explain the main groups of nonmetal elements	CPL-2
CPMK-06	Able to perform general and specific laboratory work using relevant methods and technologies.	CPL-5 CPL-7

No	Jenis Penilaian	Bobot (%)	CPMK 1	CPMK 2	CPMK 3
1	Partisipasi Kelas	10	Lembar penilaian partisipasi kelas (setiap pertemuan): a. Kehadiran b. Kedisiplinan c. Partisipasi kelas d. Inisiatif	-	-
2	Kepemimpinan, kedisiplinan, kemandirian , profesionalitas, mengembangkan jejaring	5	Lembar Observasi Kepemimpinan, kedisiplinan, kemandirian , profesionalitas, mengembangkan jejaring (pertemuan ke 3, (9-10), (12-16)	-	-
2	Penugasan Mandiri	5	-	Penugasan mandiri 1 (minggu ke 4); 5%	
3	Penugasan Mandiri Studi Kasus	10	-	1. Penugasan Mandiri Studi Kasus 1 (minggu ke 2); 5%	-
			-	2. Penugasan Mandiri studi kasus 2 (minggu ke 11); 5%	-
4	Penugasan Kelompok Studi Kasus	30	-	1. Penugasan kelompok studi kasus-PBL 1 (minggu ke 3); 5%	-
			-	2. Tugas kelompok studi kasus 2 (minggu ke 6-7) 10%	
			-	3. Tugas kelompok studi kasus 3 (minggu ke 8) 10%	
			-	4. Tugas kelompok studi kasus 4 (minggu ke 9-10); 5%	
5	Kuis-tes tulis	5	-	Kuis 1 (minggu ke. 5); 5%	-
6	Group Project	20	-	-	Penugasan Project (minggu ke 12-16); 20%
7	Ujian Akhir Semester	15	-	Tes Tettulis; 10%	Tes Tertulis; 5%

K. Curriculum Quality Assurance

The curriculum quality assurance system implemented in the Chemistry Study Program is an **outcome-based quality assurance system**, namely a monitoring and evaluation system designed to ensure continuous quality improvement and to guarantee the achievement of the established standards and learning outcomes set by the program. The outcome-based quality assurance system begins with the establishment of learning outcome standards and concludes with a systematic and sustainable process to ensure the attainment and enhancement of those standards.

In line with the implementation of the University's Internal Quality Assurance System, curriculum quality assurance in the Chemistry Study Program is carried out in accordance with the quality assurance system applied at the Faculty of Mathematics and Natural Sciences (FMIPA). This is implemented through the quality assurance cycle consisting of **Determination, Implementation, Evaluation, Control, and Improvement (PPEPP)**. The following steps are undertaken to ensure curriculum quality:

1. Curriculum Determination

Curriculum determination is carried out by the university leadership every 4–5 years by defining the graduate profile, program objectives, program learning outcomes

(PLOs), courses with their credit weights, and an integrated curriculum structure. The determination process involves the formulation and confirmation of standard documents, which may be supplemented with guidelines, manuals, Standard Operating Procedures (SOPs), and forms.

2. Curriculum Implementation

Curriculum implementation is the execution of the established standards. This is carried out through the learning process with attention to the achievement of PLOs, at the graduate level (PLO), at the course level (CLO), and at the sub-course level (sub-CLO). The implementation refers to the Course Syllabus (*Rencana Pembelajaran Semester* or RPS) prepared by lecturers or teaching teams. Sub-CLOs and CLOs for each course must contribute to the attainment of the PLOs assigned to the respective course.

3. Curriculum Evaluation

Curriculum evaluation is conducted against the established standards. Formative evaluation is carried out to monitor the achievement of PLOs through the assessment of CLOs and sub-CLOs determined at the beginning of the semester by lecturers/teaching teams and the study program. Evaluation also covers learning models, teaching methods, assessment methods, syllabi, and supporting learning tools.

Summative evaluation is conducted periodically every 4–5 years, involving both internal and external stakeholders. This review is undertaken by subject matter experts, professional associations, and industry representatives, and is aligned with the latest developments in science and technology as well as user needs.

4. Curriculum Control

Curriculum control is conducted every semester using indicators based on the measurement of PLO achievement. This process is managed by the Study Program and monitored by the University's quality assurance unit.

5. Curriculum Improvement

Curriculum improvement is based on the results of both formative and summative evaluations. The PPEPP cycle produces **Continuous Quality Improvement (CQI)** of the established standards, thereby fostering a culture of quality within the program.

L. Courses Description

The description of each course in the Bachelor of Chemistry, both to achieve the main PLO and additional PLO, is presented in Tables 25 and 26.

Table 25. Course Description

No	Code	Course Name	Course Description
Curriculum Compulsary Courses (MKWK)			
1	MWK60201	Islamic Education*	This course is conducted in order to facilitate muslim students to have a complete personality (kaffah) by making Islamic teachings as the basis for their thinking, attitudes, and behavior, especially in the development of their knowledge and profession. A complete personality can only be realized by instilling faith and piety in Allah SWT. The awareness of faith and piety can only be realized if it is supported by the development of its elements, namely: insight/Islamic knowledge, religious attitudes (religion dispositions), skills in practicing Islamic teachings (Islamic skills), Islamic commitment, self-confidence as a Muslim, and competence

No	Code	Course Name	Course Description
			in practicing religious teachings (Islamic competence).
	MWK60202	Catholic Education*	The Catholic Education course covers topics such as humanity and its origins, the human calling, religious plurality and interfaith dialogue, Jesus proclaiming the Kingdom of God, Jesus completing His work of salvation, the Holy Trinity, the Church originating from Jesus Christ and the mission of the Church, Mary in the history of salvation, faith in the context of the Republic of Indonesia and amid advances in science and technology, Catholic marriage, and social and moral issues as challenges to faith.
	MWK60203	Christian Education*	The Christian Education course provides spiritual guidance and direction for Christian students in carrying out activities as students and individuals who need to begin to live responsibly within the spiritual framework.
	MWK60204	Hinduism Education*	The Hindu Education course covers topics such as introduction, the One Supreme God, humanity, law, ethics, science and technology, art from a Hindu perspective, religious harmony, culture as an expression of the Hindu experience, politics from a Hindu perspective, and leadership studies.
	MWK60205	Buddhism Education*	The Buddhist Education course covers the basic concepts of Buddhism, including the substance of the study of God, humanity, law, morality, culture, and science and technology, as an introduction to the Buddhist personality.
	MWK60206	Confucianism Education*	The Confucian Education course covers the importance of religion in daily life with the right attitude. This course provides an understanding of the sources of Confucian law, knowing the history of Confucianism, being able to practice the Holy Way brought by the Great Teachings (Thai Hak), and the role of Confucianism in the development of science and technology.
2	MWK60207	Civic Education	Civic Education serves as an orientation for students in strengthening their national awareness and spirit, love for the country, democracy, legal awareness, appreciation for diversity, and participation in nation building based on Pancasila. In accordance with its function, Civic Education provides education on nationalism, democracy, law, multiculturalism, and citizenship for students to support the development of citizens who are aware of their rights and obligations, as well as intelligent, skilled,

No	Code	Course Name	Course Description
			and of good character, so that they can be relied upon to build the nation.
3	MWK60208	Pancasila	This course provides a basic understanding of the fundamental concepts of Pancasila as the philosophical foundation of the state and everything related to the existence and embodiment of Pancasila values in the life of society, nation, and state in the fields of development. This course covers Introduction to the Course, Pancasila in Study, History of the Indonesian Nation, Pancasila as the Foundation of the State, Pancasila as the State Ideology, Symbols of Pancasila, Pancasila as a Philosophical System, Pancasila as an Ethical System, and the Practice of Pancasila (Analysis of the essence of Pancasila).
4	MWK60209	Indonesian Language	The Indonesian language course includes teaching materials to improve students' ability to use Indonesian properly and correctly, both verbally and in writing, especially in composing paragraphs, essays, academic writing, and presenting them accurately and politely.
University Compulsary Courses (MKWU)			
5	MWU60201	English for Specific Purposes (2025)	The English course is intended for UNY students to improve their general English skills, master technical and specific vocabulary relevant to their field of study or work, develop communication skills, and prepare students to enter the workforce and/or pursue further studies at the next level of education. The learning materials include authentic texts relevant to students' fields of study, such as books, popular articles, scientific articles, infographics, and technical manuals. Learning focuses on understanding and producing various types of academic and professional oral/written texts, including descriptive, procedural, argumentative, and hortatory exposition. The learning approach adopts the Teaching and Learning Cycle from the Genre-Based Approach and integrates case study and project-based learning. Lecture activities include face-to-face lectures, discussions, individual and group assignments, case studies, and presentations. Assessment is conducted through written assignments, classroom observations, mid-semester tests, and final semester exams and/or final projects based on the students' scientific context.

No	Code	Course Name	Course Description
6	MWU60202	Sport and Physical Fitness (2025)	The Physical Education and Fitness course is a compulsory course with 2 credits of theory, which is implemented as 1 credit of theory and 1 credit of practice, meaning 8 theory sessions and 8 practice sessions. This course aims to increase physical activity and improve students' lifestyles. This course examines the concepts of physical fitness, the basics of physical fitness training, methods of physical fitness training, the development of physical fitness training programs, physical fitness programs developed in line with modern sports trends, accompanied by physical fitness evaluations in accordance with the concepts, with an emphasis on enjoyable sports activities. The course is conducted through discussions, case studies, observation assignments, and critical analysis of physical fitness practices. This course can be assessed using the criteria and norms in the physical fitness guidelines. Assessment methods may include practical tests and individual and group assignments.
7	MWU60203	Sustainable Education and Development	The Sustainable Education and Development course aims to provide students with an understanding of the concepts, principles, and practices of sustainable development that focus on social, economic, and environmental aspects. In this course, students will learn the importance of education in driving positive change that supports sustainable development goals, as well as how education can be a tool for achieving a balance between human needs and environmental preservation.
Faculty Compulsary Courses (MKF)			
8	FMI60201	Mathematics-Natural Science Insight and Studies	The Mathematics-Natural Sciences Insight and Studies course covers basic mathematics and natural sciences methods (scientific methods and attitudes) in problem solving and ways/techniques of drawing conclusions based on correct reasoning (mathematical logic). This course also covers the integration of various scientific disciplines for the advancement of chemistry, including photosynthesis and the food chain, the philosophy of science, logic, decision-making principles, scientific methods, scientific attitudes and character building, the relationship between mathematics and science and other

No	Code	Course Name	Course Description
			natural sciences, biology and the integration of each system, as well as the role of mathematics and natural sciences in research and technology development. Learning activities take the form of face-to-face lectures with an expository approach through lectures, discussions, and problem solving (structured assignments: case-based projects and problem-based learning). Assessment is based on several aspects, namely attitude, activity, structured assignments (case-based projects and problem-based learning), midterm exams, and final exams with different weights for each aspect.
9	FMI60202	Basic Statistic	The Statistics course covers the following topics: (1) the definition and role of statistics; (2) methods of data collection and presentation; (3) measures of central tendency, measures of location, and measures of data dispersion; (4) basic concepts of probability, random variables, and probability distributions; (5) sampling distributions; (6) parameter estimation; (7) hypothesis testing; and (8) correlation and regression tests.
Chemistry Compulsary Courses (MKPKP)			
10	SKM60201	Mathematics for Chemistry	Mathematics for Chemistry is designed to equip students with an understanding of basic mathematical concepts and the skills to apply these principles to solve chemistry problems. Topics covered include two- and three-dimensional coordinate systems, single and multiple variable functions, derivatives and integrals and their applications, differential equations, matrices and determinants, mathematical operators, vectors, and the basics of experimental data processing. Learning is conducted through interactive lectures, exercises, guided discussions, and case studies relevant to chemistry. A problem-based approach and integration of theory and practice are used to reinforce students' understanding. Assessment is conducted comprehensively through individual or group assignments, midterm exams, final exams, and mini-projects or case studies of mathematics applications in chemistry.
11	SKM60202	Physics for Chemistry	The Physics for Chemistry course is a compulsory course for the Department of Chemistry Education, so chemistry students must take this course. This

No	Code	Course Name	Course Description
			course is a theoretical course covering the following topics: Introduction to Physics and Measurement, Vector Analysis, Kinematics, Dynamics, Constants and Spring Forces, Heat, Coefficient of Linear Expansion, Surface Tension of Liquids, Fluid Mechanics, Static Equilibrium and Elasticity, First Law of Thermodynamics, Kinetic Theory of Gases, and Second Law of Thermodynamics. Lectures are conducted through face-to-face meetings, discussions, and structured assignments that provide students with experience in solving problems in the field of chemistry using physics concepts. Assessment is based on several aspects, namely attitude, participation, structured assignments in the form of projects and case studies, both individual and group, midterm exams, and final exams, with different weights for each aspect.
12	SKM60203	Biology for Chemistry (2025)	The Biology for Chemistry course provides a basic understanding of the principles of life that are relevant to Chemistry students. The objective of this course is to introduce the biological concepts that underlie chemical processes in living systems, as well as to understand the relationship between biology and chemistry in various biological processes. The scope of the course covers topics such as cell structure and biomolecular function, metabolism, basic genetics, organ systems in organisms, and the interaction of organisms with their environment. The learning process is conducted through face-to-face meetings, group discussions, and structured assignments. Assessment is based on: participation, structured assignments, midterm exams, and final exams with different weights.
13	SKM60204	Environmental Chemistry	After completing this course, students are expected to be able to analyze the interaction of chemical species with living things and the air, water, and soil environments. In addition, students will be able to apply chemical concepts, principles, laws, calculations, and theories to solve environmental problems in everyday life and demonstrate responsibility in preserving the environment. This course examines the sources, reactions, transportation, effects, and influences of chemical

No	Code	Course Name	Course Description
			species on the air, water, and soil environments, living organisms, and the effects of human activities on these processes. The course is conducted through blended learning: face-to-face in class, online via Zoom meetings and the Bsmart website. The methods used are information discussions, presentations, and assignments. The strategies used are case studies and project-based learning. Assessment includes attendance, presentations, project assignments, midterm exams, and final exams.
14	SKM60205	Basic of Computational Chemistry	This course aims to equip students with the fundamentals of computational chemistry theory and practice. The course covers basic Fortran programming, basic Linux commands, ChemDraw usage, modeling and analysis of simple molecular conformations (n-butane, alanine decapeptide), QSAR, molecular docking (AutoDock), and molecular dynamics simulation (GROMACS). Learning is conducted through lectures, discussions, and project-based practical work. Assessment is based on assignments, practical work, final projects, midterm and final exams.
15	SKM60206	Quantum Chemistry	This course aims to provide conceptual and mathematical understanding of the principles of quantum mechanics and their application in chemical systems. The material covers wave-particle duality, the photoelectric effect, de Broglie's hypothesis, and time-independent wave equations. Students will learn about normalized wave functions, operators, and probabilities, as well as the application of quantum models such as one- to three-dimensional boxes, the free electron model (FEMO), rigid rotors (1 and 2 degrees of freedom), and simple harmonic oscillators (SHO). Advanced topics include π-electron molecular orbital theory using the Hückel method and term symbol determination. The learning process involves lectures, concept discussions, analytical exercises, and simple numerical modeling. Assessment is conducted through individual assignments, quizzes, midterm and final exams, and projects applying quantum concepts in molecular systems.
16	SKM60207	Physical Organic Chemistry	This Physical Organic Chemistry course covers theories including

No	Code	Course Name	Course Description
			stereochemistry, stereochemical reactions, types of organic chemical reactions (substitution, addition, elimination, molecular rearrangement, oxidation, reduction) and reactions in aromatic compounds.
17	SKM60208	Chemistry Laboratory Management	After completing this course, students are expected to be able to explain the design and layout of a chemistry laboratory, make an inventory of equipment and materials, manage equipment, materials, and waste in a chemistry laboratory, understand safety equipment, and prevent accidents in a chemistry laboratory. In addition, students will be skilled in preventing workplace accidents, managing spills, and performing first aid in chemical laboratories. This course examines the design and layout of school chemical laboratories; inventory of equipment and materials; management of equipment and chemicals; safety equipment; first aid for chemical injuries, chemical laboratory waste management, and chemical spill management. The course is conducted through blended learning: face-to-face in class, online through Zoom meetings and the Bsmart website. The methods used are information discussions, presentations, and assignments. The strategies used are case studies and project-based learning. Assessment includes attendance, presentations, project assignments, midterm exams, and final exams.
18	SKM60209	Advanced Biochemistry (2025)	Advanced biochemistry courses study the basic concepts of metabolism, including bioenergetics and metabolic regulation. This course also examines catabolic and anabolic reactions involving biomolecules such as carbohydrates, lipids, and amino acids, along with energy calculations and protein biosynthesis. In addition, this course discusses the latest developments in biochemistry research. Lectures are conducted through case study-based discussions and group projects. The course emphasizes the ability to master course material logically and scientifically, as well as the ability to use scientific methods to solve problems faced by students. Assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), assignments, midterm

No	Code	Course Name	Course Description
			exams, and final exams with varying weights.
19	SKM60210	Surface Chemistry	This course aims to equip students with knowledge of surface chemistry and its applications in everyday life. Topics covered include the structure and properties of solid surfaces as adsorbents, examining their relationship with adsorption-desorption processes and mechanisms, theories underlying gas-solid and liquid-solid adsorption processes, analytical techniques, and examples of their applications in everyday life. Lectures are conducted using discussion methods, assignments, and case studies from various reliable literature. Assessment is based on participatory activities, including project completion and case studies, as well as assignments, quizzes, and midterm and final exams.
20	SKM60211	Inorganic Reaction Mechanism	The Inorganic Reaction Mechanisms course discusses the basic concepts and principles underlying chemical reactions in inorganic systems. The scope of this course covers the mechanisms of inorganic reactions at the molecular and atomic levels, as well as the factors that influence the rate, pathway, and outcome of these reactions. Learning is conducted through face-to-face lectures using discussion methods and structured case study-based assignments. Assessment is based on attitude, participation, structured assignments, midterm exams, and final exams with varying weights.
21	SKM60212	Atomic and Molecular Spectroscopy	This course aims to equip students with knowledge of molecular symmetry concepts and the fundamentals of spectroscopy. Students will learn about symmetry operations, point group determination, energy/wave relationships, and spectroscopy, including rotational spectroscopy, vibrational spectroscopy, electronic transition spectroscopy, photoelectron spectroscopy, and their applications in chemical systems. The course is conducted using discussion methods, projects, problem-based learning, and independent study using Moodle (besmart). Assessment includes participatory activities in group projects and case studies from various literature, completion of assignments, and tests

No	Code	Course Name	Course Description
			including quizzes, midterm and final exams.
22	SKM60213	Structure Elucidation of Organic Compounds	This course discusses the principles and applications of spectroscopy techniques in the analysis of organic chemical compound structures. The material covered includes the basic concepts and working principles of UV-Vis, IR, ^1H-NMR, ^13C-NMR, and MS (mass spectrometry) spectroscopy. Students will learn the spectral characteristics of each technique and how to interpret data to identify functional groups, carbon skeletons, and molecular configurations. Data from various spectroscopy techniques are used integratively to construct complete compound structures. Through case discussions, exercises, and real spectrum studies, students will develop analytical and critical thinking skills in solving organic molecular structure problems. This course is important to equip students with basic skills in organic chemistry research, compound synthesis, and chemical-based product development. Assessment is based on several aspects, namely attitude, participation, structured assignments, midterm exams, and final exams, with different weights for each aspect.
23	SKM60214	Structure Elucidation of Inorganic Compounds	This course studies the characterization of inorganic materials using UV-Vis Spectrometer, FT-IR and Raman Spectroscopy, X-ray Diffraction (XRD), and SEM instruments. The study focuses on the structure of inorganic salts, coordination compounds, aluminosilicate materials (zeolite, clay), and metal oxides. Learning is conducted through face-to-face lectures using discussion methods and structured assignments based on case studies/team-based projects. Assessment is based on attitude, participation, structured assignments, midterm exams, and project reports with varying weights.
24	SKM60215	Topics in Chemistry Research	This course discusses trends in chemical research covering various fields of chemistry, including analytical, physical, organic, inorganic, biochemical, and computational chemistry. This course also discusses literature searches and research proposal writing skills, particularly Chapter 1 (background, problem identification, problem limitations, problem formulation,

No	Code	Course Name	Course Description
			objectives and benefits), and conducts an introductory study of literature reviews, as well as the ethics of writing research proposals and articles. Learning is conducted through face-to-face lectures using discussion methods and structured assignments based on case studies/team-based projects. Assessment is based on attitude, participation, structured assignments, and project results with varying weights.
25	SKM60301	Basic Inorganic Reactions	This course covers the basic principles of inorganic reactions, identifying inorganic reactions, and studying inorganic reactions in aqueous and non-aqueous media. The course covers types of inorganic reactions, acid-base reactions and redox reactions, inorganic reactions in aqueous media: the process of dissolving inorganic compounds in aqueous media, the effect of temperature and other factors on the solubility of inorganic compounds in aqueous media, the mechanism of dissolving inorganic compounds in aqueous media, inorganic reactions in non-aqueous media: understanding the properties of non-aqueous solvents (liquid ammonia, liquid HF, liquid SO2, liquid HCN, and acetic acid), classification of non-aqueous solvents, selection of non-aqueous media for inorganic reactions, and examples of the role of non-aqueous solvents. Learning is conducted through face-to-face lectures using discussion and structured assignment methods as well as laboratory work. Assessment is based on attitude, activity, structured assignments, practicum scores, midterm exams, and final exams with varying weights.
26	SKM60302	Chemical Separation Method	The Separation Methods course studies various principles of chemical separation and the factors that influence them. The principles of chemical separation include separation by precipitation, extraction, distillation, and chromatography. Separation by precipitation includes chemical and electrochemical precipitation. Separation by extraction includes liquid-liquid and solid-liquid extraction. Separation by distillation includes ordinary distillation, steam distillation, vacuum distillation, and fractionation. Separation by

No	Code	Course Name	Course Description
			chromatography includes gas chromatography, liquid-liquid chromatography, liquid-solid chromatography, and high-performance liquid chromatography (HPLC). Lectures are conducted through practical methods, case study-based information discussions, and group projects. The objectives of the lectures emphasize the ability to master the lecture material logically and scientifically, the ability to use scientific methods in problem solving, and laboratory work skills. The assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), midterm exams, and final exams.
29	SKM60401	Basic Chemistry	This course equips students with basic knowledge and skills in chemistry, including practical skills and scientific methods, so that students can understand chemical phenomena and prepare themselves for further study in the field of chemistry. The learning process in this course is integrated between theory and practice, including the use of LMS. The chemical concepts studied include atomic theory, the periodic table of elements, chemical bonding, chemical reactions and stoichiometry, thermochemistry, solution chemistry, redox and electrochemistry, carbon compounds, and chemical kinetics. Student learning success is assessed based on lecture and practicum activities, case studies or projects, quizzes, midterm exams, and final exams.
30	SKM60402	Chemical Equilibrium	This course aims to provide a basic understanding of chemical equilibrium from a thermodynamic perspective. Students will learn about gas laws, the first law of thermodynamics, thermochemistry, the second and third laws of thermodynamics, Gibbs free energy, chemical equilibrium, colligative properties, phase equilibrium, and equilibrium in electrochemical cells. The learning process is conducted through classroom activities using discussion methods, assignments, and laboratory activities. Assessment is based on laboratory activities, including participation in laboratory groups, completion of laboratory reports, pre-tests and responses, and learning activities, namely the completion of

No	Code	Course Name	Course Description
			individual and group assignments, as well as tests consisting of mid-term and final exams.
31	SKM60403	Fundamentals of Organic Chemistry	This course covers the theory and practice of basic organic chemistry, including the structure, nomenclature, properties, reactions, and reaction mechanisms of carbon-containing compounds: alkanes, alkenes, alkynes; haloalkanes; benzene and its derivatives; alkanol compounds, alkoxy alkanes, alkanals and alkanones; alkanoic acids; alkanoic acid derivatives and nitrogen compounds of amines. Theoretical learning activities take the form of face-to-face lectures using discussion methods and structured assignments. Practical learning activities are carried out face-to-face using structured assignments as a result of learning; Assessment is based on several aspects, namely attitude, activeness, structured assignments (theory and practical), mid-semester exams, and final semester exams with different weights for each aspect.
32	SKM60404	Fundamental of Inorganic Chemistry	This course covers theory and practice including: hydrogen atom structure, periodicity of elements, molecular structure (ionic and covalent bonds, Lewis structure), acids and bases (Arrhenius, Bronsted–Lowry, Lewis, Ussanovic, HSAB) and non-metallic main group elements. This course also studies the concepts of metallic bonds, ionic bonds, properties, reactions, and uses of alkali metals, alkaline earth metals, aluminum, transition elements, tin and lead, iron corrosion and its prevention, as well as reactions in various types of batteries. Learning is conducted through face-to-face lectures using discussion methods and structured assignments, as well as laboratory work. Assessment is based on attitude, participation, structured assignments, practical work scores, midterm exams, and final exams, each with different weightings.
33	SKM60405	Fundamental of Analytical Chemistry	Fundamentals of Analytical Chemistry covers qualitative and quantitative chemical analysis. Qualitative chemical analysis involves the identification and separation of analytes in the form of anions and cations in aqueous solutions in samples using specific reagents.

No	Code	Course Name	Course Description
			Quantitative chemical analysis involves volumetric and gravimetric methods. Lectures are conducted through practical sessions, case study-based discussions, and group projects. The objectives of the lectures emphasize the ability to master the lecture material logically and scientifically, the ability to use scientific methods in solving problems faced by students, and laboratory work skills. The assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), midterm exams, and final exams.
34	SKM60406	Molecular Dynamics	The Molecular Dynamics course discusses molecular dynamics, which includes gas kinetics theory, moving molecules covering conductivity and diffusion, chemical reaction rates covering empirical chemical kinetics and explanations of rate laws and complex reaction kinetics. Lectures include theory and laboratory practicals. Assessment is based on several aspects, including participatory activities in the form of individual and group assignments, midterm exams, and final exams, with different weights for each aspect.
35	SKM60407	Biochemistry	The Biochemistry course covers the basic concepts of biochemistry, including: the structure, properties, types, and functions of several biomolecular compounds, including water and buffers, carbohydrates, fats, amino acids, proteins, enzymes, minerals, vitamins, nucleic acids, hormones, biosignaling, membranes and transport, and their interactions with living cells. This course also covers qualitative analysis (reaction testing) and quantitative analysis (concentration determination) of biomolecules, including carbohydrates, lipids, and proteins. In addition, this course studies the observation of enzyme reactions and the analysis of enzyme reaction kinetics. Lectures are conducted through case study and project-based discussions, group practicums, and practicum report writing. The objective of the course is to emphasize the ability to master course material logically and scientifically, as well as the ability to use scientific methods to solve problems faced by students. Assessment components include cognitive, affective,

No	Code	Course Name	Course Description
			and psychomotor aspects in the form of attendance, participation (case studies and projects), assignments, laboratory reports, midterm exams, and final exams with varying weights.
36	SKM60408	Structure of Organic and Polyfunctional Compounds	This course covers the theory and practice of discussing the structure, properties, and reactivity of polyfunctional organic compounds that have more than one functional group. Students will learn stereochemistry and molecular structures of several polyfunctional chemical compounds such as aldols, αβ unsaturated carbonyl compounds, amides, carbohydrates, proteins, and lipids. This course consists of theoretical concepts accompanied by synthesis techniques in the laboratory, identification and isolation of several polyfunctional compounds. Assessment is based on several aspects, namely attitude, activity, structured assignments, midterm exams, and final exams, with different weights for each aspect.
37	SKM60409	Coordinate Chemistry and Organometallics	This course studies transition metals in relation to their properties, reactivity, and tendency to form complex compounds, history and naming rules, isomerism and chirality in complex compounds, formation of complex compounds through: valence bond theory (hybridization), crystal field theory, and molecular orbital theory, properties of complex compounds: electronic spectra, magnetic properties, thermodynamic aspects, and their applications. This course also covers organometallic compounds, types of organometallic reactions, and applications of organometallic compounds. Learning is conducted through face-to-face lectures using discussion methods and structured assignments, as well as laboratory work. Assessment is based on attitude, participation, structured assignments, laboratory grades, midterm exams, and final exams with varying weights.
35	SKM60410	Chemical Instrumentation	The Chemical Instrumentation course covers the scope of chemical instrumentation and the principles of chemical instrumentation. The

No	Code	Course Name	Course Description
			principles of chemical instrumentation studied in this course include colorimeters, UV-VIS spectrophotometers, FTIR (Fourier Transform Infrared), Mass Spectrometers, NMR (Nuclear Magnetic Resonance), Gas Chromatography, Voltameters, and SSA (Atomic Absorption Spectrophotometers). Lectures are conducted through practical sessions, case study-based discussions, and group projects. The objectives of the course emphasize the ability to master course material logically and scientifically, the ability to use scientific methods to solve problems encountered by students, and laboratory work skills. Assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), midterm exams, and final exams.

Table 26. Additional Chemistry Course Description (MKPKP)

No	Code	Course Name	Course Description
MKPKP Renewable and Functional Material Competence			
1	SKM60216	Polymer Chemistry	The Polymer Chemistry course equips students with knowledge of the basic concepts of polymer science, polymerization reactions, polymer characterization, polymer properties, and polymer developments based on existing research. Learning activities consist of face-to-face lectures using discussion methods and structured assignments. Assessment is based on several aspects, namely attitude, activity, structured assignments in the form of projects and case studies, both individual and group, midterm exams, and final exams, with different weights for each aspect.
2	SKM60217	Nuclear Chemistry	After completing this course, students are expected to be able to explain radioactivity, nuclear processes, and the properties of atomic nuclei and their applications in everyday life. Nuclear chemistry is a branch of chemistry that studies radioactivity, nuclear processes, and

No	Code	Course Name	Course Description
			the properties of atomic nuclei. Nuclear chemistry focuses on changes that occur in atomic nuclei, including radioactive decay and nuclear transmutation. In addition, nuclear chemistry also studies the applications of radioactive substances in various fields such as medicine, agriculture, and industry. The lectures emphasize the ability to master lecture material logically and scientifically, as well as the ability to use scientific methods in solving problems faced by students. Lectures are conducted through blended learning: face-to-face in class, online through Zoom meetings and the Bsmart website. The methods used are information discussions, presentations, and assignments. The strategies used are case studies and project-based learning. Assessment includes attendance, presentations, project assignments, midterm exams, and final exams.
3	SKM60218	Advanced Computational Chemistry	This course expands students' understanding of advanced computational chemistry theory and applications in modeling molecular structures, properties, and reactivity. The theoretical material covers an introduction to computational chemistry, MM, semiempirical, ab initio, DFT, and molecular dynamics approaches; potential energy surface (PES) concepts; basis sets; Z-matrix and Cartesian coordinates; and docking and molecular dynamics simulation techniques. The practicum covers the use of Gaussian and GROMACS programs to calculate energy, NMR spectra, molecular magnetic properties, molecular coordinates, reaction thermochemistry, PES graphs, as well as docking and water dynamics simulations. Learning is conducted through interactive lectures, software demonstrations, and computer practicums. Assessment is based on assignments, practicum

No	Code	Course Name	Course Description
			reports, final projects, midterm exams, and final exams, with an emphasis on calculation accuracy and method selection, and scientific interpretation of simulation results.
4	SKM60219	Chemical Applications of Group Theory	The Group Theory Chemistry application explains elements and symmetry operations, and their application in orbital objects and various chemical geometries, as well as the application of group theory in chemical bonding theory, molecular orbitals, and crystal field theory related to d orbital splitting in octahedral and tetrahedral fields. Learning is conducted through face-to-face lectures using discussion methods and structured assignments based on case studies/team-based projects. Assessment is based on attitude, participation, structured assignments, midterm exams, and final exams with varying weights.
5	SKM60220	Inorganic Chemical Synthesis	This course discusses the concepts of inorganic material synthesis reactions, thermodynamic and kinetic analysis of inorganic material synthesis, methods of inorganic material synthesis, parameters and factors that influence inorganic compound synthesis, and techniques for analyzing materials resulting from inorganic compound synthesis. The learning process for the Inorganic Synthesis course is conducted through a combination of face-to-face lectures (discussing synthesis theory, thermodynamics/kinetics, and material characterization), journal-based case discussions, and group projects to design synthesis protocols. Learning evaluation covers cognitive aspects (midterm/semester exams and quizzes), skills (practical reports and synthesis projects), and affective aspects (discussion participation and individual reflection), with an emphasis on data analysis, synthesis

No	Code	Course Name	Course Description
			design creativity, and scientific presentation skills.
6	SKM60221	Crystallograpgy and Solid State Inorganic Chemistry	This course covers the state of solids, single crystal and polycrystalline growth, synthesis and physical characterization of single crystals, solid materials, solid solutions, and crystal defects. In addition, the material covered in crystal chemistry includes: description of chemical structure, symmetry and molecular groups, chemical bonds and lattice energy, molecular structure, crystal lattice, X-ray diffraction instruments, and determination of simple crystal structures. The learning process involves interactive lectures (discussing crystal structure theory, chemical bonding, and X-ray diffraction), demonstrations of single and polycrystalline crystal growth, and analysis of simple crystal structure data using crystallography software. Learning evaluation includes a theoretical exam to test understanding of crystallochemistry and solid-state thermodynamics concepts, individual project reports assessing diffraction data analysis skills, group projects involving crystal structure simulation or material synthesis, presentations, and active participation in discussions. Assessment focuses on the accuracy of data interpretation, mastery of characterization techniques, and the ability to systematically solve crystallography problems.
7	SKM60222	Nanochemistry Technology	This course covers basic and advanced concepts in nanochemistry, including the structure and properties of nanomaterials, the principles of

No	Code	Course Name	Course Description
			nanomaterial synthesis and characterization, and their applications in the fields of energy, the environment, and biomedicine. Students will understand the relationship between nano structure and chemical function and reactivity, and be able to apply the principles of nanochemistry to solve chemical problems through sustainable and environmentally friendly technological approaches. The learning process is carried out through lectures, case studies, assignments, and group discussions.
8	SKM60223	Bioinorganic Chemistry	This course examines the importance of inorganic elements and compounds in biological processes, particularly the role of certain metal ions in the active sites of proteins and enzymes. Course material includes a review of topics in inorganic chemistry, biochemistry, and molecular biology, and the relationships between them. Subsequent material covers bioinorganic reactions, essential elements and their behavior in biological systems, as well as metal metabolism and physiology. The course will also examine recent developments in the use of inorganic ions and compounds in the medical world. Learning is conducted through face-to-face lectures using discussion methods and structured case study-based assignments. Assessment is based on attitude, participation, structured assignments, midterm exams, and final exams with varying weights.
9	SKM60224	Material Chemistry	This course examines the relationship between the structure, properties, and performance of

No	Code	Course Name	Course Description
			materials, as well as various chemical aspects in designing and synthesizing functional materials. The scope of this course includes understanding the development and terminology of materials, types of materials, advanced and functional materials, smart materials, and future developments in materials. Learning is conducted through face-to-face lectures using discussion methods and structured assignments based on case studies/team-based projects. Assessment is based on attitude, participation, structured assignments, midterm exams, and final exams with varying weights. .
10	SKM60225	Membrane Technology	This course aims to equip students with knowledge and broaden their understanding of the fundamentals of membrane technology, principles of separation using membranes, preparation of ceramic and polymer membranes, characterization of membrane materials, membrane processes and systems, membrane applications in food processing, drinking water supply, waste purification and electrolyte polymers, and various other applications in everyday life. The course will be conducted using discussion methods, project-based learning, and case studies. Assessment will be based on participation in project activities, case studies, group assignments, independent work, and tests, including quizzes, midterm exams, and final exams.
11	SKM60226	Catalyst Chemistry	The Catalytic Chemistry course covers the basic concepts of catalysts, types of catalysts, principles of homogeneous catalysts and their mechanisms, enzymatic reactions, heterogeneous catalysts and their mechanisms, catalyst synthesis, and

No	Code	Course Name	Course Description
			the properties and applications of catalysts in various fields. The course is conducted through face-to-face lectures, discussions, and structured assignments that provide students with experience in solving problems in the field of catalysis. Assessment is based on several aspects, namely attitude, participation, structured assignments in the form of projects and case studies, both individual and group, midterm exams, and final exams, with different weights for each aspect.
12	SKM60227	Geochemistry	This course covers theory including material on the principles and history of geochemistry, the Earth and its relationship with the universe, the structure and composition of the Earth, thermodynamics and crystal chemistry, magmatism and igneous rocks, sedimentation and sedimentary rocks, and isotope geochemistry.
MKPKP Kompetensi Kimia Hayati			
1	SKM60228	Pharmaceutical Chemistry	Studying the basic concepts of the historical development of medicine, the principles of pharmacokinetics, the principles of pharmacodynamics, the chemical structure and physicochemical properties of drug molecules, the biopharmaceutical aspects of drugs, methods of drug administration, the main effects and side effects of drug use, the interaction of drug structure with receptors and their biological activity (drug metabolism), and the relationship between drug structure and activity. Learning activities consist of face-to-face lectures with an expository approach through lectures, discussions, and problem solving (structured assignments: case-based projects and problem-based learning); Assessment is based on several aspects, namely attitude, activity,

No	Code	Course Name	Course Description
			structured assignments (case-based projects and problem-based learning), midterm exams, and final exams, with different weights for each aspect.
2	SKM60229	Molecular Biothecnology	The Molecular Biotechnology course aims to provide an understanding of the basic principles of biotechnology, particularly molecular techniques relevant to the field of chemistry. Students are expected to understand the concepts and applications of molecular biotechnology in various sectors, including the pharmaceutical, agricultural, and environmental industries, as well as in research, and to gain insight into classical biotechnology as the basis for the development of molecular technology. The scope of the course covers the following topics: introduction to molecular biotechnology, classical biotechnology, DNA and molecular genetics, molecular techniques, genetic engineering, applications of molecular biotechnology, and ethics and regulations in biotechnology. The learning process is conducted through lectures, case studies/projects, discussions, assignments, and presentations. Assessment is based on: participation, completion of projects/case studies, assignments, midterm exams, and final exams.
3	SKM60230	Food Chemistry	The Food Chemistry course covers the basic concepts and scope of food chemistry as well as the nutritional composition of food, including water, macronutrients (carbohydrates, proteins, fats), micronutrients (vitamins, minerals, additives, preservatives). This course also examines the reactions that occur during the preparation, processing, and storage of food, as well as the identification of food contamination and spoilage (physical, chemical, and biological). In addition, this course also covers food analysis, including food standards and food product

No	Code	Course Name	Course Description
			safety technology. Lectures are conducted through case study-based information discussions and group projects. The objective of the lectures is to emphasize the ability to master lecture material logically and scientifically, as well as the ability to use scientific methods in solving problems faced by students. Assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), assignments, midterm exams, and final exams with varying weights.
4	SKM60231	Synthetic Organic Chemistry	This course covers concepts such as: principles of disconnection approaches; basic principles of aromatic compound synthesis; sequence of steps in organic compound synthesis; disconnection of one C-X group: derivatives of carbonyl compounds RCO. X derivatives of carboxylic acids, alcohol compounds, alkyl halides, sulfides, ethers; chemoselectivity; two C-X group disconnection: 1,1-difunctional compounds, 1,2-difunctional compounds, 1,3-difunctional compounds; synthesis of amines, protective groups Learning activities consist of face-to-face lectures with an expository approach through lectures, discussions, and problem solving (structured assignments: case-based projects and problem-based learning); Assessment is based on several aspects, namely attitude, activity, structured assignments (case-based projects and problem-based learning), midterm exams, and final exams with different weights for each aspect.
5	SKM60232	Cosmetics Chemistry (2025)	This course covers the basic principles of chemistry in cosmetics in terms of definitions, main functions, classification from various perspectives, constituent materials, chemical-physical manufacturing

No	Code	Course Name	Course Description
			processes, essential ingredients, hazardous ingredients, safe manufacturing for health, traditional cosmetics, and research development in cosmetics. The learning process for the Cosmetic Chemistry course is carried out through interactive lectures (discussing the chemical principles of cosmetic formulation, active ingredients, and product safety), case studies analyzing the composition of commercial cosmetics, and discussions related to BPOM regulations and trends in natural/nanotechnology cosmetics. Learning evaluation includes a theoretical exam on ingredient classification and cosmetic mechanisms of action, a group project involving the formulation of innovative products with raw material analysis, a presentation on traditional or modern cosmetic literature reviews, individual analysis reports assessing preparation techniques and data analysis, and active participation in discussions on the ethics of sustainable cosmetic development, with an emphasis on understanding the dangers of chemicals, formulation creativity, and awareness of legal-industrial aspects.
6	SKM60233	Forensic Chemistry (2025)	The Forensic Chemistry course aims to provide students with an understanding of the concepts, techniques, and applications of chemistry in forensic investigations. Students will learn how chemistry is used to analyze evidence in criminal cases, as well as the role of chemistry in identifying materials and substances relevant to legal investigations. In addition, this course aims to develop students' skills in understanding the forensic process and the ethical and regulatory aspects related to the use of chemistry in legal investigations. The scope of the course covers the

No	Code	Course Name	Course Description
			following topics: introduction to forensic chemistry, chemical analysis techniques in forensics, forensic sample analysis, drug and poison chemistry, DNA chemistry in forensics, criminal case investigation in chemistry, and ethical and legal aspects of forensic chemistry. The learning process is carried out through lectures, case studies, discussions, assignments, and presentations. Assessment is conducted through: participation, completion of case studies, assignments, midterm exams, and final exams.
7	SKM60234	Isolation anf Identification of Natural Compound	This course discusses the principles, techniques, and applications of isolation and identification of organic compound structures from natural materials. Students learn various isolation methods such as extraction, maceration, percolation, Soxhlet extraction, and chromatography. In addition, students are equipped with an understanding of the use of spectroscopic methods such as UV-Vis, IR, NMR (^1H and ^13C), and MS in identifying the structure of natural compounds. The focus of study includes terpenoids, flavonoids, polyketides, polyphenols, steroids, alkaloids, and other bioactive compounds commonly found in plant families. Students are trained to analyze scientific journals, critically discuss isolation and identification techniques, and present their findings orally and in writing. This course is designed to develop students' logical, systematic, and scientific thinking skills in the study of natural compounds relevant to research, industry, and natural product development. Assessment is based on several aspects, namely attitude, activity, structured

No	Code	Course Name	Course Description
			assignments, midterm exams, and final exams, with different weights for each aspect.
8	SKM60235	Reaction Mechanism of Organic Compound	This course discusses the basic concepts and principles of organic compound reaction mechanisms, including substitution, addition, elimination, electrophilic, nucleophilic, radical, and pericyclic reactions. Students will learn the conditions, requirements, and effects of functional group structures on the course of reactions, as well as systematically writing and analyzing reaction mechanisms. Learning is conducted through lectures, discussions, case studies, and individual or group assignments. This course aims to equip students with a deep understanding of organic compound transformations, as well as critical and logical thinking skills in solving organic reaction-based chemistry problems. Assessment is based on several aspects, namely attitude, activity, structured assignments, midterm exams, and final exams, with different weights for each aspect.
9	SKM60236	Toxycology	This course covers the direction of toxicology, general principles and thinking patterns in toxicology, acute doses, chronic doses, and dose-response relationships, types of subject situations, toxicity, absorption, distribution, excretion, reactions caused by conjugation, reduction, oxidation, and hydrolysis in air contaminants, including radioactive waste and drugs, various types of toxicology, and the use of toxicology. Learning activities consist of face-to-face lectures using an expository approach through lectures, discussions, and problem solving (structured assignments: case-based

No	Code	Course Name	Course Description
			projects and problem-based learning); Assessment is based on several aspects, namely attitude, activity, structured assignments (case-based projects and problem-based learning), midterm exams, and final exams with different weights for each aspect.
10	SKM60237	Enzymology	The Enzymology course aims to provide an understanding of the structure, function, mechanism of action, kinetics, and purification of enzymes, as well as to develop students' ability to analyze enzyme characteristics and utilize enzymes for various practical applications, including enzyme immobilization. Course scope: history of enzymes, fundamentals of enzymology, enzyme nomenclature, enzyme structure and classification, enzyme action mechanisms, enzyme kinetics, enzyme activity regulation, factors affecting enzyme activity, enzyme isolation, enzyme immobilization, and enzyme applications in industry. The learning process is carried out through lectures, case studies/projects, discussions, assignments, and presentations. Assessment is based on: participation, completion of case studies/projects, assignments, midterm exams, and final exams.
11	SKM60238	Petroleum Chemistry and Energy	The Petroleum Chemistry course explains petroleum, its discovery, exploration, exploitation, and processing. It also explains petroleum products, including how they are made, their chemical and physical properties, and quality benchmarks. This course also discusses energy and potential energy sources other than petroleum.

No	Code	Course Name	Course Description
			Learning is conducted through face-to-face lectures using discussion methods and structured assignments based on case studies/team-based projects. Assessment is based on attitude, participation, structured assignments, midterm exams, and final exams with varying weights.
12	SKM60239	Fermentation Technology	The course covers the development of fermentation technology, fermentation principles, the behavior and metabolism of biological agents in fermentation, fermentation methods and kinetics, sterilization, and the characteristics and handling of media and inoculation as well as fermenters.
13	SKM60240	Medicinal Chemistry	This course covers an overview of drugs and drug targets, drug classification, pharmacodynamics and pharmacokinetics, drug discovery, design and development; combinatorial and parallel synthesis, software in medicinal chemistry, quantitative structure-activity relationships (SAR, QSAR), and drug activity as antibacterial, antiviral, anticancer, opioid analgesic, antiulcer, cholinergic, anticholinergic, and anticholinesterase agents, as well as drugs that act on the adrenergic nervous system. Learning activities consist of face-to-face lectures with an expository approach through lectures, discussions, and problem solving (structured assignments: case-based projects and problem-based learning). Assessment is based on several aspects, namely attitude, activity, structured assignments (case-based projects and problem-based learning), midterm exams, and final exams, with different weights for each aspect.
14	SKM60241	Physiscal Biochemistry	This course covers the basic concepts and principles of physical biochemistry, including: the

No	Code	Course Name	Course Description
			relationship between theoretical concepts and bioscience; the origins of various formulas/equations in physical biochemistry; and the application of simple calculations. In addition, this course will cover intra- and inter-molecular interactions in biomolecules, the structure of proteins and nucleic acids, the function of proteins in relation to enzyme catalysis energetics and membrane transport processes, protein folding models, the thermodynamics and kinetics of protein folding, and interactions between macromolecules. Lectures are conducted through case study-based discussions and group projects. The objective of the lectures is to emphasize the ability to master the lecture material logically and scientifically, as well as the ability to use scientific methods in solving problems faced by students. The assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), assignments, midterm exams, and final exams with different weights.
MKPKP Kompetensi Kimia Ramah Lingkungan			
1	SKM60242	Analytical Electrochemistry	The analytical electrochemistry course studies electrochemistry concepts and their applications in chemistry. These concepts include: chemical changes and electrolysis of electrical energy (redox reactions that require energy to occur), galvanic or voltaic cells (reactions that release energy when they occur). In addition, this course also studies chemical instrumentation that uses electrochemical concepts, including potentiometers, voltameters, and polarography. Lectures are conducted through case study-based discussions and group projects. The course emphasizes the

No	Code	Course Name	Course Description
			ability to master course material logically and scientifically, as well as the ability to use scientific methods to solve problems encountered by students. Assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), midterm exams, and final exams
2	SKM60243	Corrosion and Electroplating Chemistry	This course aims to provide an understanding and insight into corrosion chemistry and various methods of prevention. Students will learn the redox concepts underlying corrosion reactions, types of corrosion, corrosion analysis techniques, various methods and mechanisms of prevention, and their application in everyday life. In addition, various surface coating methods such as electrodeposition and passivation will be introduced, along with their uses in everyday life. The lectures are conducted through group discussions, assignments, project-based learning, and case studies. Meanwhile, assessment is based on participatory activities in the form of project and case study completion, quizzes, midterm and final exams, and assignment completion.
3	SKM60244	Radioanalysis	The Radioanalysis course studies the chemical properties of radioactive nuclides, radioactivity measurements, and their use in analytics. The subject of radioanalysis covers the concepts of radioactivity, radioactivity measurements, hot atom chemistry, the application of radionuclides in analytics, and the application of radionuclides in engineering and industry. The course objectives emphasize the ability to master course material logically and scientifically, the ability to use

No	Code	Course Name	Course Description
			radioanalysis theories and their application in engineering and industry. Assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), midterm exams, and final exams.
4	SKM60245	Management of Hazardous and Toxic Waste	The Hazardous and Toxic Waste Management course studies the physical and chemical properties of hazardous and toxic waste and its management in relation to environmental health. The course material covers the definition, properties, and classification of B3 waste; regulations related to B3 waste management; identification, documentation, symbols, labeling, packaging, storage, collection, transportation, processing, utilization, stockpiling, and final disposal of B3 waste; emergency response systems in B3 waste processing; processing of hospital waste; chemical laboratories; chemical industries; printing; and radioactive waste. The objectives of the course emphasize the ability to master course material logically and scientifically, as well as the ability to use scientific methods to solve problems. Lectures are conducted using a case study-based information discussion method and group projects. Assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), midterm exams, and final exams.
5	SKM60246	Coloid and Surfactant	Students learn about the types, characteristics, structure, and methods of colloid production, their stability, and their applications in daily life and industry. Meanwhile, the material on surfactants covers the structure of surfactants, their characteristics and stability, examining their relationship with various chemical processes and

No	Code	Course Name	Course Description
			mechanisms, as well as their applications in everyday life. Students also study the properties at the interface, the factors that affect their performance, and apply these concepts in several cases. Lectures are conducted using discussion, presentation, individual and group assignments, and case studies that provide students with experience in problem solving. Assessment is based on student participation activities, namely case studies and group project completion, quizzes, assignments, and midterm and final exams.
MKPKP Kompetensi Kimia Industri			
1	SKM60247	Industrial Materials Analysis	Industrial Materials Analysis covers analysis of the water industry, steel industry, trace elements in minerals, cement industry, paint industry, glass industry, and ceramics industry.
2	SKM60248	Industrial Chemistry	Industrial Chemistry consists of physical and chemical processes in industries including sugar cane, paper, Portland cement, ammonia, urea fertilizer, textiles, and milk powder; the use of stoichiometry concepts and calculations of heat released in a chemical process. The Industrial Chemistry course is taught through interactive lectures that discuss the physical-chemical principles of industrial processes, case studies, virtual visits/factory process simulations, and discussions on environmentally friendly technologies and industrial process optimization. Learning evaluation includes theoretical exams, project assignments, group presentations on case studies, virtual visit/simulation reports, and active participation, with an emphasis on technical calculation skills, process analysis, and understanding of large-scale industrial chemistry applications.
3	SKM60248	Industrial Management	The Industrial Management course discusses the safe, effective, and efficient management of an industry, as well as following the principles of

No	Code	Course Name	Course Description
			green and sustainable chemistry. In addition, managerial concepts, risk management, and ISO standardization concepts are also introduced. The learning process is carried out through interactive lectures that discuss the principles of industrial management based on green chemistry and sustainability, real case studies of the application of ISO quality management systems and risk management in the chemical industry, managerial decision-making simulations, as well as industrial visits or guest lectures from practitioners to enrich practical knowledge. Learning evaluation includes midterm and final exams to master basic concepts, case analysis assignments on the application of green chemistry principles in industry, group projects to design a mini industrial management system with a sustainable approach, presentations on ISO standard implementation studies in chemical companies, and active participation in discussions and responses, with an emphasis on system analysis skills, understanding of industry standards, and the development of innovative and responsible managerial solutions.
4	SKM60248	Data Science and Programming	This course aims to equip students with the fundamentals of data science and programming applied in the context of chemistry. The material covers how to manage, analyze, and visualize experimental or chemical simulation data using programming languages such as **Python** or **R**. The main focus includes processing spectroscopy data, reaction kinetics, thermodynamic data, molecular simulation results, and statistical modeling in chemical research. Students will also be introduced to data science libraries such as **NumPy, Pandas, Matplotlib**, and **SciPy**, as well as basic machine learning techniques relevant to

No	Code	Course Name	Course Description
			predicting compound properties, analyzing large experimental data sets, and data-driven material design. Emphasis is placed on hands-on practice, the use of real chemical datasets, and the integration of ethical principles and scientific integrity in chemical data management. Learning is designed based on hands-on practice, real-world case discussions, and mini-projects. Assessment is based on assignments, practical work, final projects, midterm and final exams.
Additional Competency Course(MKTK)			
1	SKM60305	Chemical Entrepreneurship, KWU Kimia (2025)	The KWU Chemistry course covers several topics, including developing an entrepreneurial spirit and character, motivation to achieve, creative thinking, the essence of entrepreneurship, business ethics and social responsibility, finding new ideas, production management, and marketing. This course provides students with entrepreneurial knowledge and skills to develop their businesses early on and in a guided manner. The objectives of this course are to equip students with entrepreneurial spirit and character, an understanding of the concept of entrepreneurship, and entrepreneurial skills through the practice of product creation and marketing, as well as sales reporting. The course is conducted using a discussion-based information and project-based practice method in groups. The assessment components include cognitive, affective, and psychomotor aspects in the form of attendance, participation (case studies and projects), midterm exams, and final exams.

M. Rencana Pembelajaran Semester

Contoh RPS

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN, RISET, DAN TEKNOLOGI
UNIVERSITAS NEGERI YOGYAKARTA
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
PROGRAM STUDI KIMIA - S1

RENCANA PEMBELAJARAN SEMESTER (RPS)

Program Studi	:	KIMIA - S1
Mata Kuliah/Kode	:	Kesetimbangan Kimia/SKM60405
Jumlah SKS	:	4
Tahun Akademik	:	2025
Semester	:	2
Mata Kuliah Prasyarat	:	-
Dosen Pengampu	:	1. Prof. Dr. Dra. Isana Supiah YL. M.Si. 2. Prof. Dr. Dra. Isana Supiah YL. M.Si. 3. Yunilia Nur Pratiwi S.Pd., M.Pd.
Bahasa Pengantar	:	Bahasa Indonesia

A. DESKRIPSI MATA KULIAH

Matakuliah Kesetimbangan Kimia membahas tentang konsep gas dan sifat-sifatnya, hukum pertama termodinamika serta aplikasinya, termokimia, hukum kedua dan ketiga termodinamika serta aplikasinya, keseimbangan kimia, keseimbangan fasa, sifat-sifat fisika larutan, serta keseimbangan elektrokimia

B. CAPAIAN PEMBELAJARAN LULUSAN (CPL) DAN CAPAIAN PEMBELAJARAN MATA KULIAH (CPMK)

Nomor	Capaian Pembelajaran Mata Kuliah (CPMK)	Capaian Pembelajaran Lulusan (CPL)

1	Mahasiswa mampu menguasai konsep gas dan sifat-sifatnya serta konsep dan prinsip kesetimbangan kimia dengan kinerja mandiri, bermutu, dan terukur	S9. Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri
		P2. Mampu menguasai konsep, prinsip dan keterampilan di bidang ilmu kimia yang mencakup struktur, dinamika, energetika, dan pengukurannya secara mendalam yang berorientasi pada kecakapan hidup
		KU2. Mampu menunjukkan kinerja mandiri, bermutu, dan terukur;
		KK1. Mampu melakukan pekerjaan laboratorium yang bersifat general dan spesifik, serta teknik sintesis dan pengukuran.
2	Mahasiswa mampu menerapkan konsep dan prinsip termodinamika dalam problema kesetimbangan kimia dan sifat-sifat gas	P1. Mampu menggunakan konsep- konsep dasar ilmu fisika, biologi, kimia dan matematika untuk berinovasi dalam memecahkan masalah kimia.
		KK1. Mampu melakukan pekerjaan laboratorium yang bersifat general dan spesifik, serta teknik sintesis dan pengukuran.
3	Mahasiswa mampu menganalisis sifat-sifat gas dan problema kesetimbangan kimia berdasarkan prinsip termodinamika berbasis proyek secara bertanggung jawab	P2. Mampu menguasai konsep, prinsip dan keterampilan di bidang ilmu kimia yang mencakup struktur, dinamika, energetika, dan pengukurannya secara mendalam yang berorientasi pada kecakapan hidup
		KU5. Mampu mengambil keputusan secara tepat dalam konteks penyelesaian masalah di bidang keahliannya, berdasarkan hasil analisis informasi dan data;
		KK2. Mampu menganalisis secara sistematis berbagai alternatif solusi terkait identifikasi, analisis, isolasi, transformasi, dan sintesis bahan kimia sederhana.
		KU12. Dapat menerapkan prinsip-prinsip dasar untuk pelaksanaan proyek terkait dengan bidang kimia dan mampu mengembangkan tanggung jawab kepemimpinan di bidang kimia, dan

C. KEGIATAN PERKULIAHAN:

Minggu Ke-	CPMK	Bahan Kajian	Bentuk/ Metode Pembelajaran	Pengalaman Belajar	Indikator Penilaian	Teknik Penilaian	Waktu	Referensi
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	1	Pendahuluan dan Kontrak Penelitian	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mempelajari gas dan sifat-sifatnya	Memahami konsep gas dan sifat-sifatnya	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas	4 x 50 menit	1, 2, 4, 5, 9
2	1	Gas dan Sifat-Sifatnya	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari gas dan sifat-sifatnya	Mampu memahami gas dan sifat-sifatnya	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas	4 x 50 menit	1, 2, 4, 5, 8, 9
3	2	Hukum Pertama Termodinamika dan Aplikasinya	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari hukum-hukum Termodinamika dan aplikasinya	Memahami hukum-hukum Termodinamika	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas	4 x 50 menit	3, 6, 7, 10
4	2	Hukum Pertama Termodinamika dan Aplikasinya	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mempelajari hukum pertama Termodinamika dan aplikasinya	memahami hukum pertama Termodinamika dan aplikasinya	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas	4 x 50 menit	3, 6, 7, 10
5	2	Termokimia	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari aplikasi hukum pertama Termodinamika pada proses isobaris	Mampu menyelesaikan problema termokimia	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas	4 x 50 menit	3, 6, 7, 10
6	2	Termokimia	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Menyelesaikan problema termokimia	Mampu menyelesaikan problema termokimia	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas 4. Proyek	4 x 50 menit	3, 6, 7, 10
7	2	Hukum Kedua dan Ketiga Termodinamika serta Aplikasinya	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari hukum II dan III Termodinamika	Mampu memahami hukum II dan III Termodinamika	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas 4. Proyek	4 x 50 menit	3, 6, 7, 10
8	1, 2	Ujian Sisipan	Kuis/Evaluasi	Mahasiswa mengerjakan soal ujian sisipan	Mampu menyelesaikan soal ujian sisipan	UTS	4 x 50 menit	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
9	1, 2, 3	Keseimbangan Kimia	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari Keseimbangan Kimia	Mampu mengaplikasikan hukum Termodinamika dalam konsep Keseimbangan Kimia	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas	4 x 50 menit	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
10	2, 3	Sifat Koligatif	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari SIfat Koligatif Larutan	Mampu memahami Sifat Koligatif Larutan dengan baik	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas 4. Proyek	4 x 50 menit	1, 2, 4, 5, 8, 9

11	2, 3	Sifat Koligatif Larutan	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari Sifat Koligatif Larutan	Mampu menyelesaikan problema Sifat Koligatif Larutan	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas 4. Studi Kasus	4 x 50 menit	1, 2, 4, 5, 8, 9
12	2, 3	Keseimbangan Fasa	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa mempelajari materi Keseimbangan Fasa	Mampu memahami materi Keseimbangan Fasa	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas 4. Studi Kasus	4 x 50 menit	1, 2, 4, 5, 8, 9
13	2, 3	Keseimbangan Fasa	1. Ceramah 2. Diskusi 3. Resitasi 4. Tugas/Kerja Mandiri 5. Kuis/Evaluasi	Mahasiswa menyelesaikan problema keseimbangan fasa	Mampu menyelesaikan problema keseimbangan fasa dengan baik	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas 4. Presentasi 5. Studi Kasus 6. Proyek	4 x 50 menit	1, 2, 4, 5, 8, 9
14	2, 3	Keseimbangan Elektroda	1. Ceramah 2. Diskusi 3. Eksperimen/Praktek 4. Resitasi 5. Tugas/Kerja Mandiri 6. Kuis/Evaluasi	Mahasiswa mempelajari materi Keseimbangan Elektroda	Mampu memahami materi Keseimbangan Elektroda	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas	4 x 50 menit	1, 2, 4, 5, 8, 9
15	2, 3	Keseimbangan Elektroda	1. Ceramah 2. Diskusi 3. Eksperimen/Praktek 4. Resitasi 5. Tugas/Kerja Mandiri 6. Kuis/Evaluasi	Mahasiswa menyelesaikan problema keseimbangan elektroda	Mampu menyelesaikan problema keseimbangan elektroda dengan baik	1. Kehadiran/Keaktifan 2. Kuis 3. Tugas 4. Presentasi 5. Proyek	4 x 50 menit	1, 2, 4, 5, 8, 9
16	1, 2, 3	Ujian Sisipan	Kuis/Evaluasi	Menyelesaikan soal ujian sisipan	Mampu menyelesaikan soal ujian sisipan dengan baik	UAS	4 x 50 menit	1, 2, 3, 4, 5, 6, 7, 8, 9, 10

D. KOMPONEN PENILAIAN:

Nomor	Teknik Penilaian	Persentase Bobot Penilaian	Keterangan
1.	Kognitif	50	Akumulasi bobot penilaian maksimal 50%
	a. Kehadiran	10	
	b. Kuis	10	
	c. Tugas	10	
	d. UTS	10	
	e. UAS	10	
2.	Partisipatif	50	Akumulasi bobot penilaian minimal 50%
	a. Studi Kasus	25	
	b. Team Based Project	25	
TOTAL		**100**	

E. REFERENSI

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PENUTUP

Penyusunan kurikulum Program Studi Kimia FMIPA Universitas Negeri Yogyakarta ini merupakan wujud komitmen untuk menyediakan pendidikan tinggi yang unggul, relevan, dan adaptif terhadap perkembangan ilmu pengetahuan, teknologi, dan kebutuhan masyarakat. Kurikulum ini disusun dengan mengacu pada Kerangka Kualifikasi Nasional Indonesia (KKNI), Standar Nasional Pendidikan Tinggi (SNPT), serta perkembangan terbaru dalam bidang kimia, baik secara nasional maupun global.

Kurikulum ini tidak hanya dirancang untuk membekali mahasiswa dengan pengetahuan teoritis dan keterampilan praktis di bidang kimia, tetapi juga untuk membentuk karakter ilmuwan yang beretika, berpikir kritis, kreatif, dan inovatif. Integrasi antara pembelajaran berbasis capaian (outcome-based education), penguatan soft skills, serta relevansi dengan dunia kerja dan riset menjadi pilar utama dalam kurikulum ini.

Diharapkan kurikulum ini mampu menjadi landasan kuat dalam menghasilkan lulusan yang kompeten di bidang kimia, mampu beradaptasi dengan dinamika zaman, serta berkontribusi secara nyata dalam pengembangan ilmu pengetahuan, pendidikan, industri, dan pengabdian kepada masyarakat. Kurikulum ini bersifat dinamis dan terbuka untuk dikaji serta diperbarui secara berkala guna menjawab tantangan dan peluang di masa depan.

Dengan tersusunnya kurikulum ini, Program Studi Kimia FMIPA UNY berkomitmen untuk terus meningkatkan mutu pendidikan, riset, dan pengabdian demi mendukung visi UNY sebagai universitas kependidikan kelas dunia yang unggul, kreatif, dan inovatif.