USK
UNIVERSITAS
SYIAH KUALA

Kampus Merdeka
INDONESIA JAYA


# Curriculum Handbook

## 2024-2028

Based on the Rector's Decree
Number: 3046 /UN11/KPT/2024

## Bachelor in Chemistry Program

Faculty of Mathematics and Natural Sciences

UNIVERSITAS SYIAH KUALA

Accredited
EXCELLENT

# CURRICULUM DOCUMENT
## BACHELOR IN CHEMISTRY

**UNIVERSITAS SYIAH KUALA**
**FACULTY OF MATHEMATICS AND NATURAL SCIENCES**
**DARUSSALAM 2024**

## PROGRAM OVERVIEW

### Program Specification

| | | |
|---|---|---|
| 1 | Name of Institution | Universitas Syiah Kuala |
| 2 | Name of Study Program | Bachelor in Chemistry Program (SMKM) |
| 3 | Degree Level | Bachelor |
| 4 | Address | Jl. Tgk. Syech Abdurrauf No. 3, Building B, Faculty of Mathematics and Natural Sciences, Kopelma Darussalam, Syiah Kuala District, Banda Aceh 23111, Indonesia |
| 5 | Accreditation Status | Accredited “Excellent” by LAMSAMA (BAN-PT Decree No. 655/SK/BAN-PT/AK.KP/S/II/2023) |
| 6 | Degree Title | Bachelor of Science (S.Si.) |
| 7 | Duration and Credit Load | 4 years (8 semesters), 144 SKS (credit points, equivalent to 240 ECTS) |

## PROGRAM DESCRIPTION

The Bachelor in Chemistry Program(SMKM) at Universitas Syiah Kuala (USK) was established in 1989 under the Decree of the Directorate General of Higher Education (No. 11/Dikti/Kep/1989, dated 17 February 1989), with the aim of meeting the growing demand for science graduates at the local, national, and international levels. Initially managed under the Coordinating Unit for Mathematics and Natural Sciences, the program was formally integrated into the Faculty of Mathematics and Natural Sciences (FMIPA) in 1993 through Ministerial Decree No. 383/O/1993. The program currently holds an "Excellent" accreditation status from the National Accreditation Board for Higher Education (BAN-PT), as stated in Decree No. 655/SK/BAN-PT/AK.KP/S/II/2023.

The fields of study offered in this program are designed to produce high-quality graduates with strong integrity, innovative capacity, and an entrepreneurial mindset. These attributes are supported by a solid foundation in chemistry knowledge and practical skills, as well as a high standard of intellectual and academic excellence. The curriculum is structured around five core areas of chemistry: organic chemistry, physical chemistry, inorganic chemistry, analytical chemistry, and biochemistry. The learning process is supported by 23 permanent faculty members (Appendix 1), consisting of 14 with doctoral degrees and 9 with master's degrees. Their academic ranks include 7 professors, 8 associate professors, 3 assistant professors, 5 junior assistant professor. Many faculty members earned their degrees from leading international institutions in countries such as Germany, Japan, the Netherlands, the United Kingdom, Australia, and Malaysia, as well as top universities in Indonesia, including ITB, USU, UGM, Unand, and USK.

Graduates of the SMKM have pursued careers across diverse sectors, including industry, public institutions, and education, serving as industrial practitioners, public professionals, and educators. To complete the Bachelor in Chemistry Program, students are required to earn a minimum of 144 credits (equivalent to 240 ECTS), in accordance with the Regulation of the Minister of Education, Culture, Research, and Technology of the Republic of Indonesia No. 53 of 2023. The program is designed to be completed in a minimum of four years (eight semesters) and must be finished within a maximum of seven years (fourteen semesters). A minimum cumulative IPK of 2.5 (GPA: Grade Point Average) is required for graduation. As part of the graduation requirements, students must conduct research in their chosen area of interest and complete an Bachelor in Chemistry Program.

Teaching and research activities in the SMKM are supported by comprehensive facilities, including lecture rooms, seminar rooms, administrative offices, and laboratories equipped with advanced instrumentation. These facilities play a vital role in enabling students to develop strong research skills and contribute to meaningful scientific work. As a result, Bachelor in Chemistry Program have produced a variety of scholarly outputs, including publications in reputable international journals, nationally accredited SINTA journals, and registered patents and copyrights. The program attracts students from diverse educational backgrounds, including general high schools, vocational schools, and Islamic senior secondary schools, reflecting its broad accessibility and appeal. As of 2024, there are 276 active students enrolled in the program, with an average annual intake of approximately 77 new students.

**CURRICULUM DEVELOPMENT COMMITTEE DECREE**

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KEPUTUSAN REKTOR UNIVERSITAS SYIAH KUALA
NOMOR No SK: 74/UN11.1.8/KPT/2024
TENTANG
PENUNJUKAN TIM PENYUSUN KURIKULUM OUTCOME BASED EDUCATION (OBE) PADA PROGRAM STUDI SARJANA KIMIA JURUSAN KIMIA FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM UNIVERSITAS SYIAH KUALA

REKTOR UNIVERSITAS SYIAH KUALA,

Menimbang :

a. bahwa untuk kelancaran pelaksanaan kegiatan Penyusunan Kurikulum Outcome Based Education (OBE) pada Program Studi Sarjana Kimia Jurusan Kimia Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Syiah Kuala, maka perlu ditunjuk Tim Penyusun yang bertugas untuk itu;
b. bahwa untuk keperluan dimaksud, perlu ditetapkan dengan Keputusan Rektor;

Mengingat :

1. Undang-Undang Nomor 17 Tahun 2003 tentang Keuangan Negara;
2. Undang-Undang Nomor 1 Tahun 2004 tentang Perbendaharaan Negara;
3. Undang-Undang Nomor 12 Tahun 2012 tentang Pendidikan Tinggi;
4. Undang-Undang Nomor 19 Tahun 2023 tentang Anggaran Pendapatan dan Belanja Negara Tahun Anggaran 2024;
5. Peraturan Pemerintah Nomor 4 Tahun 2014 tentang Penyelenggaraan Pendidikan Tinggi dan Pengelolaan Perguruan Tinggi;
6. Peraturan Pemerintah Nomor 38 Tahun 2022 tentang Perguruan Tinggi Negeri Badan Hukum Universitas Syiah Kuala;
7. Peraturan Menteri Keuangan Nomor 49 Tahun 2023 tentang Standar Biaya Masukan Tahun Anggaran 2024;
8. Peraturan Rektor Nomor 5 Tahun 2024 tentang Organisasi dan Tata Kerja Unsur Rektor Universitas Syiah Kuala;
9. Keputusan Rektor Universitas Syiah Kuala Nomor 6002/UN11/KPT/2023 tentang Pemberhentian/Pengangkatan Dekan Fakultas MIPA Universitas Syiah Kuala periode 2023-2026;
10. Keputusan Rektor Universitas Syiah Kuala Nomor 1470/UN11/KPT/2024 tentang Pelimpahan Kewenangan Penandatanganan Keputusan Rektor Kepada Wakil Rektor, Ketua Lembaga, Dekan, dan Direktur Sekolah Pascasarjana Universitas Syiah Kuala;

MEMUTUSKAN:

Menetapkan : KEPUTUSAN REKTOR TENTANG PENUNJUKAN TIM PENYUSUN KURIKULUM OUTCOME BASED EDUCATION (OBE) PADA PROGRAM STUDI SARJANA KIMIA JURUSAN KIMIA FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM UNIVERSITAS SYIAH KUALA.

KESATU : Menunjuk Saudara-saudara yang namanya tercantum pada daftar lampiran keputusan ini sebagai Tim Penyusun kegiatan Penyusunan Kurikulum Outcome Based Education (OBE) pada Program Studi Sarjana Kimia Jurusan Kimia Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Syiah Kuala.

KEDUA : Kegiatan ini dilaksanakan pada bulan Januari 2024 sampai dengan bulan Juni 2024.

KETIGA : Segala biaya yang diakibatkan oleh keluarnya keputusan ini dibebankan pada Anggaran PTNBH Universitas Syiah Kuala Tahun Anggaran 2024 SUKPA Fakultas Matematika dan Ilmu Pengetahuan Alam yang sesuai dengan Peraturan Keuangan.

KEEMPAT : Keputusan ini mulai berlaku pada tanggal 2 Januari 2024 dan apabila dalam penetapan ini kemudian ternyata terdapat kekeliruan akan diperbaiki kembali sebagaimana mestinya.

Ditetapkan di Banda Aceh
pada tanggal 16 April 2024

a.n. REKTOR UNIVERSITAS SYIAH KUALA,
DEKAN FAKULTAS MATEMATIKA DAN ILMU
PENGETAHUAN ALAM

Prof. Dr. Taufik Fuadi Abidin, S.Si., M.Tech
NIP 197010081994031002

LAMPIRAN
KEPUTUSAN REKTOR UNIVERSITAS SYIAH KUALA
NOMOR No SK: 74/UN11.1.8/KPT/2024, TANGGAL 16 APRIL 2024
TENTANG
PENUNJUKAN TIM PENYUSUN KURIKULUM OUTCOME BASED EDUCATION (OBE) PADA PROGRAM STUDI SARJANA KIMIA JURUSAN KIMIA FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM UNIVERSITAS SYIAH KUALA

| No | Nama/NIP/NIPK | Pangkat/Gol | Jabatan dalam Dinas | Jabatan dalam Panitia | Rincian Tugas | Tugas dan Fungsi |
|---|---|---|---|---|---|---|
| 1 | Dr. Khairi, S.Si., M.Si. 196906141999031002 | Pembina (Gol. IV/a) | Ketua Jurusan Kimia | Pengarah | Memberi arahan pada pelaksanaan kegiatan penyusunan kurikulum OBE Departemen Kimia | Ya |
| 2 | Irfan Mustafa, S.Si., M.Si 197411302002121001 | Penata (Gol. III/c) | Sekretaris Jurusan Kimia | Penanggung Jawab | Bertanggung jawab dalam kegiatan penyusunan kurikulum OBE Prodi Sarjana Kimia dan mengkoordinir penyusunan profil lulusan, Kompetensi dan CPL | Ya |
| 3 | Dr. Nazaruddin, S.Si, M.Si 197006211997031002 | Penata (Gol. III/c) | Lektor | Ketua | Mengkoordinir kegiatan penyusunan bahan kajian, mata kuliah, CPMK dan bobot SKS per mata kuliah Prodi Sarjana Kimia | Tidak |
| 4 | Kartika MZ, S.Si., M.Si 199401212022032010 | Penata Muda Tk. I (Gol. III/b) | Tenaga Pengajar | Sekretaris | Mengkoordinir kegiatan penyusunan Kode Mata Kuliah, Prasyarat, Struktur Kurikulum dan Daftar Ekuivalensi Mata Kuliah di Prodi Sarjana Kimia | Tidak |
| 5 | Dr. Surya Lubis, S.Si, M.Si 196905101999032001 | Pembina (Gol. IV/a) | Koordinator Program Studi S-2 Kimia | Anggota | Mengkoordinir penyusunan Mata Kulish Bidang Kimia Anorganik | Tidak |
| 6 | Muhammad Bahi, S.Si.,M.Sc.,Ph.D. 197209281997021001 | Pembina (Gol. IV/a) | Lektor Kepala | Anggota | Mengkoordinir penyusunan Mata Kulish Bidang Kimia Organik | Tidak |
| 7 | Dr. Elly Sufriadi, S.Si., M.Si 197103302000121001 | Penata (Gol. III/c) | Lektor | Anggota | Mengkoordinir penyusunan Mata Kulish Bidang Kimia Analitik | Tidak |
| 8 | Dr. Febriani, S.Si, M.Si 197202171999032001 | Pembina (Gol. IV/a) | Lektor Kepala | Anggota | Mengkoordinir penyusunan Mata Kulish Bidang Biokimia | Tidak |
| 9 | Dr. Julinawati, S.Si., M.Si 197107011997022001 | Penata Tk. I (Gol. III/d) | Lektor Kepala | Anggota | Mengkoordinir penyusunan Mata Kulish Bidang Kimia Fisika | Tidak |
| 10 | Wahyuna, A.Md. 198910022012012101 | - | Pengadministrasi Akademik | Anggota | Membantu tugas ketua dan sekretaris dalam penyusunan dokumen-dokumen kurikulum | Tidak |

Ditetapkan di Banda Aceh
pada tanggal 16 April 2024

a.n. REKTOR UNIVERSITAS SYIAH KUALA,
DEKAN FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

Prof. Dr. Taufik Fuadi Abidin, S.Si., M.Tech
NIP 197010081994031002

## PREFACE

The development and revision of a curriculum are critical steps in ensuring the academic quality of a study program. This process aims to equip students with competencies aligned with advancements in science and technology, while also preparing them to respond to increasingly complex and competitive challenges in the Global era. In this context, it is essential to align the curriculum with current trends, including the technological shifts of the Fourth Industrial Revolution, the *Merdeka Belajar Kampus Merdeka* (MBKM) policy, Ministry of Education Regulation No. 53 of 2023 on Quality Assurance in Higher Education, and the institutional transformation of Universitas Syiah Kuala as a State Higher Education Institution with Legal Entity (*Perguruan Tinggi Negeri Badan Hukum* – PTNBH) status.

Curricular reform across all study programs within the Faculty of Mathematics and Natural Sciences (FMIPA), Universitas Syiah Kuala (USK), adopts the Outcome-Based Education (OBE) approach. This framework ensures that the curriculum is designed to achieve clearly defined and measurable learning outcomes. In an OBE-based curriculum, every aspect of instruction is structured to align with specific and relevant goals, particularly those that reflect real-world professional demands. Consequently, the curriculum design, assessment strategy, and instructional process are all oriented toward the attainment of predetermined learning outcomes.

The current development of the OBE curriculum has been guided by a range of considerations, including Ministry Regulation No. 53 of 2023, the Indonesian National Qualifications Framework (KKNI), MBKM policies, technological and scientific advancements, as well as input from professional associations, government bodies, industry stakeholders, and alumni. Nevertheless, we acknowledge that the curriculum may still have room for improvement. Therefore, we sincerely welcome constructive feedback and recommendations for its future refinement.

We extend our deepest gratitude to department leaders, program coordinators, curriculum development teams, and all parties who have contributed and provided support throughout the process of curriculum revision. We hope that this newly developed curriculum will bring substantial benefits to students and graduates of FMIPA USK.

Darussalam, May 6, 2024

Dean,

Prof. Dr. Taufik Fuadi Abidin, S.Si., M. Tech.

# TABLE OF CONTENT

# CHAPTER 1
# INTRODUCTION

The curriculum of SMKM was developed in accordance with the procedures established by USK, as outlined in the Curriculum Development Guidebook 2024–2028. The development process involved multiple stakeholders, including academic associations, subject-matter experts, employers, and benchmarking with comparable study programs.

## 1.1 Curriculum Development Process

The curriculum development process in SMKM follows these stages:

a. The Study Program convenes a meeting to form a curriculum development committee.
b. The committee reviews relevant regulations and guidelines issued by both the Ministry of Education and Culture and USK.
c. The committee analyzes the results of graduate employability surveys conducted by USK's Career Development Center (CDC) as a reference for formulating graduate profiles.
d. A tracer study is conducted involving alumni, employers, academic partners, and professional or disciplinary organizations.
e. The curriculum team and peer group identify core subject areas, Intended Learning Outcomes (ILO), Course Learning Outcomes (CLO), and Sub-CLO.
f. All ILOs are consolidated and discussed in a program-level meeting for finalization.
g. Courses are structured and distributed across semesters, followed by the formulation of syllabi/ Semester Learning Plan (Ind.:RPS), course contracts, and assessment rubrics.
h. Integration of the MBKM policy, a government initiative enabling students to gain real-world experience through internships, research, and off-campus learning, is addressed along with alignment of foundational courses across departments.
i. The curriculum draft is submitted to the Directorate of Education and Learning at USK for quality assurance and review.
j. Following revisions based on the review, the curriculum document is approved by the Rector and uploaded to the official website of the Bachelor in Chemistry Program.

## 1.2 Curriculum Evaluation and Tracer Study

A. Curriculum Implementation Evaluation

The evaluation of curriculum implementation is based on a tracer study conducted by the Career Development Center (CDC), a technical implementation unit under Universitas Syiah Kuala. The CDC conducts surveys during the second half of each academic year, targeting alumni who graduated one year prior. The survey is administered online using a combination of instruments: (1) the National Higher Education Questionnaire (Dikti), (2) the Indotrace Questionnaire, and (3) USK's institutional requirements.

The tracer study for the Bachelor in Chemistry Program was conducted on graduates from 2021 and 2022. These cohorts were selected under the assumption that they had completed their studies under the 2021 curriculum. Graduates from 2023 were excluded, as they had not yet reached one year post-graduation at the time of the study. Of the 64 graduates from 2021 and 2022, 60 completed the survey in full, resulting in a completion rate of 93.83%. Survey results show that approximately 43% of respondents were employed, 10% had pursued further studies, and 5% were engaged in entrepreneurship. Meanwhile, 42% were still seeking employment one year after graduation.

Around 69% of graduates secured a job within three months of graduating. However, 11% obtained employment between 10–12 months, and 4% took more than 1.5 years to find work. About 19% of respondents had applied for jobs before graduating, with 15% receiving job offers prior to graduation. Of the employed graduates, 65% worked full-time, 19% part-time, and 12% freelance. Employment status varied, with 46% working on a contract basis, 23% holding permanent positions, and 15% working without formal contracts. The majority (58%) were employed in the private sector, 19% were self-employed or operated their own businesses, and 8% worked in government institutions. Notably, 11% did not disclose their place of employment.

The most common employment sectors included education (34%), manufacturing/processing industries (23%), and self-employment (8%), while 23% were employed in other sectors. Initial monthly salaries varied widely: 38% earned less than IDR 2.5 million, 46% earned between IDR 2.5 and 5 million, 12% between IDR 5 and 7.5 million, and 4% reported earning more than IDR 10 million.

Half of the respondents reported working in jobs that were highly relevant or relevant to their field of study. Nearly one-third considered their jobs somewhat relevant, while fewer than 20% felt their jobs were not aligned with their academic background. A majority (84%) believed that their first job matched their level of education, 8% worked in positions requiring a lower level, 4% in roles requiring a higher level, and 4% were in jobs not requiring a university degree.

In terms of recruitment, the most important factors considered by employers were personality traits and ICT skills, followed by work experience and the university's reputation. Other influential attributes included academic program, foreign language proficiency, and organizational experience. GPA and letters of recommendation were generally not considered critical in the hiring process.

B. Rationale for Curriculum Revision

1. Stakeholder feedback from tracer study

The results of the tracer study provide insights from stakeholders regarding the competencies required of graduates in the job market. These inputs have served as key references in formulating the Intended Learning Outcomes (ILO), study content, and CPMK.

2. Changes in internal and external policies

Internally, USK transitioned from a Public Service Agency (BLU) to a Legal Entity State University (PTNBH), which mandates the implementation of an Outcome-Based Education (OBE) curriculum. Externally, curriculum development aligns with the Ministry of Education, Culture, Research, and Technology Regulation No. 53 of 2023 on Quality Assurance in Higher Education.

3. Developments in science and technology

Recent developments in instructional technology have necessitated updates to teaching methodologies. The Semester Learning Plan (RPS) has become a central component of the learning process. With the increasing integration of technology in education, the curriculum must adapt to remain current and effective.

4. Alignment with the Evolving Sustainable Development Goals (SDGs)

The global community has committed to addressing environmental and developmental challenges through the Sustainable Development Goals (SDGs). These goals are reflected in the curriculum through learning outcomes that support sustainable development. A majority of the SDG targets have been embedded into the design of ILO and CLO.

5. Analysis of USK's Vision and Curriculum Development Priorities

Following Universitas Syiah Kuala's transition from a Public Service Agency (ind: BLU) to a Legal Entity State University (ind: PTNBH), its vision and mission have been revised accordingly. This institutional transformation has resulted in elevated learning outcome targets, thereby necessitating a comprehensive curriculum review.

6. Analysis of Faculty and Study Program Vision and Mission

In line with changes at the university level, the vision and mission of the faculty and the study program have also been updated. These revisions highlight the need for curriculum adjustments to ensure alignment with institutional goals.

C. Summary of Curriculum Revisions

Several key changes have been made and implemented in the 2024 Outcome-Based Education (OBE) curriculum, including :

1. Strengthening of graduate profiles by integrating entrepreneurial competencies (*entrepreneurship*).
2. Enhancement of course content based on the standards of the Royal Society of Chemistry (RSC) and international accreditation requirements set by ASIIN.
3. Revision of Course Learning Outcomes (CLO) to align with the updated vision and mission of USK, FMIPA, and the Bachelor in Chemistry Program.
4. Structural adjustments in the course distribution, particularly for those involving laboratory components.
5. Redesign of the RPS to adopt the OBE-based format, replacing the previous structure.

### 1.3 Foundations for Curriculum Design and Development

The curriculum of the SMKM is designed and developed based on the following legal, regulatory, and institutional frameworks:

1. The 1945 Constitution of the Republic of Indonesia, Law No. 12 of 2012 on Higher Education, and the philosophical foundations of Pancasila.
2. Presidential Regulation of the Republic of Indonesia No. 8 of 2012 concerning the Indonesian National Qualifications Framework (KKNI).
3. National Standards for Higher Education as stipulated in the Regulation of the Minister of Research, Technology, and Higher Education No. 44 of 2015.
4. Regulation of the Minister of Education, Culture, Research, and Technology No. 53 of 2023 on Quality Assurance in Higher Education.
5. Curriculum Development Guidelines of Universitas Syiah Kuala (2023)
6. Strategic Plan of Universitas Syiah Kuala (2022).
7. Strategic Plan of the Faculty of Mathematics and Natural Sciences (2022).

# CHAPTER 2
# VISION, GOALS, AND STRATEGIC DIRECTIONS OF THE PROGRAM

## 2.1 Vision and Mission of the Study Program

2.1.1 Vision

The Bachelor in Chemistry Programconducts educational, research, and community service activities in alignment with the vision of Universitas Syiah Kuala (USK) and the Faculty of Mathematics and Natural Sciences (FMIPA). The scientific vision of SMKM forms the foundation for implementing the *Tri Dharma of Higher Education*. Table 2.1 presents the alignment among the visions of USK, FMIPA, and the Bachelor in Chemistry Program.

Table 2.1 Alignment of Visions of the SMKM, FMIPA, and Universitas Syiah Kuala

| Vision of Program | Vision of the Faculty | Vision of University |
|---|---|---|
| To develop professional chemistry graduates who demonstrate national and global competitiveness and embody a science-preneurial mindset grounded in the sustainable advancement of local natural resources by 2035. | To become an innovative, independent, and Globally recognized *socio-sciencepreneur* faculty by 2035. | To become an innovative, independent, and Globally renowned *socio-technopreneur* university. |

Table 2.2 Checklist of Vision Alignment between USK/FMIPA and the Study Program

| Keywords in the Vision of the Program | Alignment with the Vision (tick √ as appropriate) | | Description of Alignment |
|---|---|---|---|
| | Keywords in the Vision of the Faculty | Keywords in the Vision of USK | |
| Sciencepreneur | √ | √ | Aligned with the distinctive characteristics of USK's vision and mission |
| Innovative | √ | √ | Well-aligned |
| Independent | √ | √ | Well-aligned |
| Globally recognized | √ | √ | Well-aligned |
| Local natural resources | | | Represents a unique characteristic of the Chemistry Bachelor in Chemistry Program |

2.1.2 Mission of the Study Program

The implementation of the objectives of the SMKM at FMIPA USK focuses on institutional development, the production of high-quality graduates, and the establishment of national and international collaborations. These objectives are reflected in the following missions of the Study Program:

1. To produce excellent, independent, diligent, creative, innovative, entrepreneurial, and high-integrity graduates in developing and applying chemical science and technology.
2. To enhance and broaden access, quality of education, research excellence, and learning services in the field of chemistry.
3. To expand national and international collaborations with various stakeholders in the field of chemistry for the benefit of society.
4. To utilize local natural resources as a basis for learning, research, and community service activities.

## 2.2 Program Objectives

The objective of the educational, research, and community service activities of the Chemistry Bachelor of Science Program is to achieve the Intended Learning Outcomes (CPL/CPMK) aligned with the vision and mission of the Faculty of Mathematics and Natural Sciences (FMIPA) at USK, namely to establish a program that produces graduates who are excellent, independent, diligent, creative, innovative, entrepreneurial, and possess integrity in developing and applying chemical sciences and technology.

## 2.3 Strategy

The Bachelor in Chemistry Program has developed strategies to realize its vision, mission, and objectives in alignment with FMIPA and USK. The strategic targets include:

1. Improving the Quality of Education, with performance indicators such as reduced average study duration and waiting time for graduates to secure employment (≤6 months), maintaining a high average GPA, and increasing the percentage of graduates who are immediately employed.
2. Enhancing the relevance, productivity, and competitiveness of research and community service outcomes, with performance indicators including an increase in international publications, intellectual property rights (HKI), and community service activities based on research outcomes.
3. Improving the quality of student activities, indicated by an increase in the number of students with national and/or international achievements, growth in student entrepreneurship, and a consistent percentage of scholarship recipients.
4. Revitalizing the support system for *the tridharma of higher education*, with performance indicators such as an increase in the percentage of study programs with "Excellent" accreditation, an ideal student-to-lecturer ratio, the percentage of lecturers holding teaching certification, doctoral qualifications, professorial ranks, and optimal budget utilization.

## 2.4 University Core Value

The university values upheld by USK are based on its core principles: Pancasila, Sincerity, Honesty, and Togetherness, as stipulated in Article 7 of Government Regulation No. 38 of 2022.

# CHAPTER 3
# GRADUATE PROFILE AND COMPETENCY STANDARDS

The curriculum of the Bachelor in Chemistry Programhas undergone eight revisions since the operational license was issued in 1989 and the official decree of program establishment in 1993. These revisions were driven by changes in the vision and mission of the university and faculty, developments in science and technology, and the evolving needs of the job market. Accordingly, the Intended Learning Outcomes (ILO) were designed to remain adaptive to such changes.

The 2024 curriculum revision follows a structured process. The initial stages include the formulation of the vision and mission, strategies, and objectives of the study program, followed by the definition of graduate profiles, the establishment of Intended Learning Outcomes (Eng.: ILO/ Ind.: CPL), Subject Areas (Eng.: SA/ Ind.: BK), Course Learning Outcomes (Eng.: CLO/ Ind.: CPMK), and Sub-Course Learning Outcomes (Eng.: Sub-CLO/ Ind.: Sub-CPMK). Subsequent stages involve the determination of course components (description, credit units, and course codes), which are organized into a coherent course structure. Each course is equipped with a Semester Learning Plan (RPS), assessment rubrics, and a course contract.

## 3.1 Graduate Profile and Description of the SMKM

The graduate profile of the Bachelor in Chemistry Program is formulated based on the needs of the job market, including demands from government institutions, industries, and enterprises, as well as the development of science and technology. A job market needs survey was conducted involving stakeholders who could contribute to ensuring convergence and connectivity between educational institutions and the end-users of graduates, in line with the goal of quality assurance for graduate outcomes. The quality assurance of graduates in the Bachelor in Chemistry Program, Faculty of Mathematics and Natural Sciences, Universitas Syiah Kuala (USK), is informed by input from peer programs coordinated under the Indonesian Chemical Society (Ind.: HKI) and the Independent Accreditation Board for Natural Sciences and Formal Sciences (Ind.: LAMSAMA). These references provide a nationally accepted and recognized framework. The formulation of the graduate profile also considers input from partner institutions to highlight excellence and local wisdom.

The graduate profile (Ind.: PL) was established through analysis of survey data conducted by the Career Development Centre (CDC) of USK up to 2023, along with input from peer Chemistry Study Programs. Survey analysis shows that alumni are absorbed into diverse employment sectors such as private enterprises, further education, and the education sector—as civil servant teachers, government-contracted educators, and other employment schemes. Graduates also work in non-governmental organizations, government institutions (including state-owned enterprises), and other fields. The diversity of employment demonstrates the adaptability of Chemistry graduates to a wide range of career paths. Additional references for determining the graduate profile were gathered from regular national meetings of Chemistry Study Program coordinators held by the Indonesian Chemical Society (HKI). Feedback from alumni, particularly regarding challenges in the workplace, was also considered. Based on tracer study results and discussions with similar programs, the Bachelor in Chemistry

Program, Faculty of Mathematics and Natural Sciences, USK, has identified the following graduate profiles:

1. Industrial practitioners and public sector professionals (PL-01)
2. Professional educators (PL-02)

These two profiles are supported by a set of competencies acquired through the established Intended Learning Outcomes (ILO), which are outlined in Tabel 3.1.

Table 3.1. Graduate Profile Descriptions

| Code | Graduate Profile Competencies | KKNI Domains | Relevant Professional Fields |
|---|---|---|---|
| PL01 | Graduates possess competencies in scientific and technological mastery, research methods and analytical techniques, communication, managerial skills, spiritual awareness, ethics, integrity, social sensitivity, lifelong learning, and entrepreneurial character. | S + KU + KK + P | 1. Industrial practitioners and public sector professionals<br>2. Professional educators |
| PL02 | Graduates possess competencies in scientific mastery, social character, effective communication, scientific norms, and lifelong learning. | S + KU + KK + P | |

Legend:
S = Attitudes
KU = General Skills and Attitudes
KK = Specific Skills
P = Knowledge

### 3.2 Intended Learning Outcomes (ILOs) Components

The Intended Learning Outcomes (ILO) of the SMKM curriculum are formulated based on surveys of alumni, stakeholders, and peer Bachelor in Chemistry Program. These outcomes reflect the competencies required in the era of Industry 4.0, while also anticipating the emergence of Industry 5.0. They internalize several universal agendas related to sustainable development based on human rights and equality, in alignment with the Sustainable Development Goals (SDGs). The formulation of ILO refers to the National Standards for Higher Education (SN-Dikti) and the Indonesian National Qualifications Framework (KKNI) descriptors for Level 6 qualifications. Additionally, it takes into consideration the local natural resource context and adapts criteria set by professional organizations both locally and internationally, such as the *Himpunan Kimia Indonesia* (Indonesian Chemical Society/HKI) and the Royal Society of Chemistry (RSC). Several decisions and circulars issued by the Rector of USK concerning academic policies have also been adopted as reference points in formulating the ILO. These ILO are categorized into four regulatory components: Attitudes and Values, General Skills, Specific Skills, and Knowledge Mastery. The formally adopted ILO of the Bachelor in Chemistry Program are outlined in Table 1 (Appendix 2).

Each ILO is carefully described to ensure it provides the necessary competencies for graduates, and its relevance is analyzed in relation to the Graduate Profiles (PL), as identified through Tracer Study results. The alignment between each ILO and PL is tabulated in Table 3.2.

Table 3.2. Alignment between Graduate Profiles (PL) and Intended Learning Outcomes (ILO)

| Graduate Profile Code (PL) | Intended Learning Outcome (ILO) Code | Description of ILO |
|---|---|---|
| PL01 | ILO01 | To cultivate a sense of piety, ethical conduct, integrity, social consciousness and a commitment to lifelong learning. |
| | ILO02 | To effectively communicate, solve problems, collaborate within diverse environments, and comprehend the commercialization of chemical knowledge and skills. |
| | ILO04 | To effectively conduct and report the findings of chemistry research in accordance with established scientific standards, while remaining adaptable to technological advancements. |
| | ILO05 | To understand foundational concepts in chemistry, mathematics, and other natural sciences, and to proficiently apply this integrated knowledge to resolve everyday challenges. |
| PL02 | ILO01 | To cultivate a sense of piety, ethical conduct, integrity, social consciousness and a commitment to lifelong learning. |
| | IL 02 | To effectively communicate, solve problems, collaborate within diverse environments, and comprehend the commercialization of chemical knowledge and skills. |
| | ILO03 | To conduct chemical experiments independently and responsibly, as well as to manage, analyze, and interpret the resulting data. |
| | ILO04 | To effectively conduct and report the findings of chemistry research in accordance with established scientific standards, while remaining adaptable to technological advancements. |
| | ILO05 | To understand foundational concepts in chemistry, mathematics, and other natural sciences, and to proficiently apply this integrated knowledge to resolve everyday challenges. |

### 3.3 Determination of the Body of Knowledge

The formulation of Intended Learning Outcomes (ILO) in the SMKM requires a clearly defined body of knowledge in the field of chemistry to support those outcomes. Based on analyses and comparisons of various data sources — including the Royal Society of Chemistry (RSC), the Indonesian Chemical Society (*Himpunan Kimia Indonesia* or HKI), alumni and employer surveys, and international accreditation standards such as ASIIN — the body of knowledge for the Chemistry Study Program has been compiled as outlined in Table 2 (Appendix 3).

This body of knowledge forms the foundation for determining Course Learning Outcomes (CPMK). However, prior to this, an analysis of the alignment between the ILOs and the body of knowledge must be conducted to ensure that each topic area adequately supports the competencies expected of graduates. The relationship between each ILO and the respective elements of the body of knowledge is summarized in Table 3.3.

Table 3.3. Alignment between Intended Learning Outcomes (ILO) and Body of Knowledge (BK)

| ILO Code | BK Code | Body of Knowledge |
|---|---|---|
| ILO05 | BK01 | Chemical terminology and nomenclature, rules, and units. |
| ILO05 | BK02 | Properties of elements and their compounds, including group relationships and periodic trends. |
| ILO05 | BK03 | Characteristics of the different states of matter and the theories used to describe them. |
| ILO03 and ILO04 | BK04 | Types and characteristics of chemical reactions. |
| ILO03 | BK05 | Principles and procedures in chemical analysis and compound characterization. |
| ILO05 | BK06 | Principles of quantum mechanics and their application in explaining atomic and molecular structures and properties. |
| ILO03 and ILO05 | BK07 | Thermodynamic principles and their application in chemistry. |
| ILO02 and ILO03 | BK08 | Chemical reaction kinetics, including catalysis and their interpretation in chemical systems. |
| ILO03 and ILO05 | BK09 | Key techniques for structural determination based on spectroscopy. |
| ILO05 | BK10 | Properties of aliphatic, aromatic, heterocyclic, and organometallic compounds. |
| ILO02 and ILO04 | BK11 | Properties and behavior of functional groups in organic molecules. |
| ILO02 and ILO05 | BK12 | Synthesis/biosynthesis of organic, inorganic, and biomolecular compounds. |
| ILO03 and ILO05 | BK13 | Relationship between macromolecular properties and the atomic/molecular structure of their constituents, including biomolecules, polymers, and other materials. |
| ILO04 and ILO05 | BK14 | Structure and reactivity of key biomolecules and the chemistry of biological processes. |
| ILO04 and ILO05 | BK15 | Utilization and management of local natural resources. |
| ILO03 | BK16 | Laboratory safety and data management. |
| ILO01, ILO02 and ILO03 | BK17 | Values of religious, national, and local character and identity. |

### 3.4 Formulation of Course Learning Outcomes (CLO)

The Course Learning Outcomes (CLO) of the Bachelor in Chemistry Program are formulated based on the previously established body of knowledge. These outcomes are structured across five major disciplines in chemistry—namely Physical Chemistry, Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, and Biochemistry—alongside courses categorized as Program-Specific, Faculty, and University courses. The CPMKs are coded accordingly to reflect their subject area: CPKF for Physical Chemistry, CPAN for Inorganic Chemistry, CPAL for Analytical Chemistry, CPOR for Organic Chemistry, CPBI for Biochemistry, CPPS for Program-Specific Courses, and CPMU for University Courses. In addition, the CPMK for courses under the MBKM program are determined based on policies set by the FMIPA. The formulation of these learning outcomes also takes into account the required depth and breadth of course content, aligning with Level 6 of the Indonesian National Qualifications Framework (KKNI). A comprehensive list of all CPMKs for the Bachelor in Chemistry Program is provided in Table 3 (Appendix 4).

### 3.5 Course Design and Development

The development of courses in the SMKM at the FMIPA, USK, is carried out through the analysis of subject matter and Course Learning Outcomes (CLO). Each CPMK corresponds to a specific body of knowledge depending on the academic field. The credit weight (SKS) of each course is determined based on the workload related to the Intended Learning Outcomes (ILO), subject matter, CLO, and the breadth and depth of learning content. Course development involves all faculty members of the SMKM. The process begins with discussions within academic peer groups, which are then brought into program-level discussions. The final decisions are made during a departmental plenary meeting under the coordination of the curriculum development team of the study program. The following section presents the list of courses and their respective credit weights in the SMKM curriculum, 2024. The assignment of course credit weights is based on the following considerations:

a. Workload of the subject matter
b. Number of CLO
c. Breadth and depth of content according to Bloom's taxonomy

The calculation is conducted by dividing the weight of each course by the total cumulative weight of all courses, then multiplying the result by the total number of credits required to complete one study cycle in the program. The following table presents the credit allocation for each course in the SMKM.

Credit Allocation of Courses in the Bachelor in Chemistry Program(SMKM)

| Course Code | Course Title | No. of CLO | Estimated Learning Load | | Credits SKS |
|---|---|---|---|---|---|
| | | | Theory | Practical | |
| MKWU1002 | Civic Education | 1 | 5.6 hours/week × 16 = 90 / 45.28 = 2 SKS | | 2 |
| MKWU1005 | Disaster Management and Environment | 1 | 5.6 hours/week × 16 = 90 / 45.28 = 2 SKS | | 2 |
| MKWU1006 | Character Building 1 | 1 | | 2.73 hours/week × 16 = 43.68 = 1 SKS | 0 |
| SMPA1001 | Introduction to Calculus | 1 | 8.5 hours/week × 16 = 136 / 45.28 = 3 SKS | | 3 |
| SMPA1003 | Introduction to Physics | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SPHY1001 | Practicum of Introduction to Physics | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMPA1005 | Introduction to Calculus | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM1001 | Practicum of Introduction to Chemistry | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMPA1007 | Introduction to Biology | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMBI1001 | Practicum of Introduction to Biology | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMPA1011 | Statistical Methods | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| MKWU1001 | Pancasila | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| MKWU1003 | Indonesian Language | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| MKWU1004 | English | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| MKWU1007 | Character Building 2 | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 0 |
| SMPA1009 | Introduction to Industrial Revolution | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |

| | | | | | |
|---|---|---|---|---|---|
| SMKM1002 | Basic Chemistry | 2 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM1004 | Practicum of Basic Chemistry | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM1006 | Scientific Mathematics | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM1008 | Fundamental of Physics | 1 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM1010 | Laboratory Management | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM1003 | Principle of Separation Methods | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM2005 | Physical Chemistry I | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2007 | Practicum of Physical Chemistry I | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM2009 | Inorganic Chemistry I | 4 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2011 | Analytical Chemistry I | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2013 | Practicum of Analytical Chemistry I | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM2015 | Organic Chemistry I | 4 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2017 | Practicum of Organic Chemistry I | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM2019 | Biochemistry I | 4 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2021 | Practicum of Biochemistry I | 2 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| MKWU2001 | Religion Education | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM2012 | Physical Chemistry II | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |

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|---|---|---|---|---|---|
| SMKM2014 | Practicum of Physical Chemistry II | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM2016 | Inorganic Chemistry II | 6 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2018 | Practicum of Inorganic Chemistry II | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM2020 | Analytical Chemistry II | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2022 | Practicum of Analytical Chemistry II | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM2024 | Organic Chemistry II | 4 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2026 | Practicum of Organic Chemistry II | 1 | | 2,73 hours/week x 16= 43,68/45.28 = 1 SKS | 1 |
| SMKM2028 | Biochemistry II | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM2030 | Practicum of Biochemistry II | 1 | | 2,73 hours/week x x 16 = 43,68/45.28 = 1 SKS | 1 |
| SMKM3023 | Physical Chemistry III | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM3025 | Inorganic Chemistry III | 8 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM3027 | Practicum of Inorganic Chemistry III | 1 | | 2,73 hours/week x x 16 = 43,68/45.28 = 1 SKS | 1 |
| SMKM3029 | Instrumentation Analysis | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM3031 | Practicum of Instrumentation Analysis | 2 | | 2,73 hours/week x x 16 = 43,68/45.28 = 1 SKS | 1 |
| SMKM3033 | Organic Chemistry III | 4 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM3035 | Structure Elucidation of Organic | 2 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM3037 | Biochemistry III | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |

| | | | | | |
|---|---|---|---|---|---|
| SMPA3013 | Entrepreneurship | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMPA3015 | Practicum of Entrepreneurship | 1 | | 2,73 hours/week x x 16 = 43,68/45.28 = 1 SKS | 1 |
| SMKM3032 | Physical Chemistry IV | 3 | 8,5 hours/week x 16 = 136 /45.28 = 3 SKS | | 3 |
| SMKM3034 | Organometallics | 8 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM3036 | Organic Chemistry of Natural Product | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM3038 | Biochemistry Research Techniques | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM3040 | Research Methodology | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM3042 | Colloquium | 1 | | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | 2 |
| MKWUP001 | Community Service Program | 1 | | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | 2 |
| SMPAP001 | Internship | 1 | | 8,5 hours/week x 16 = 136 /45.28 = 3 | 3 |
| SMPAP002 | Research Proposal | 1 | | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | 2 |
| SMPAPA01 | Final Project | 2 | | 11.2 Hours/week x 16 = 179.2 / 45.28 = 4 SKS | 4 |
| SMKM6039 | Electrochemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6041 | Material Chemistry | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6043 | Surface Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6045 | Petroleum Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6047 | Radiation Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6049 | Bioinorganic Chemistry | 4 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6051 | Catalysts | 7 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |

| | | | | | |
|---|---|---|---|---|---|
| SMKM6053 | Mineralogy | 4 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6055 | Applied Analytical Chemistry | 3 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6057 | Environmental Chemistry | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6059 | Chemical Analysis of Halal Products | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6061 | Introduction of Chromatography | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6063 | Introduction to Organic Synthesis | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6065 | Basic Bioassay Technology | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6067 | Bioinformatics | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6069 | Food Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6071 | Medicinal Chemistry | 3 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6044 | Solid State Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6046 | Industrial Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6048 | Polymer Chemistry | 3 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6050 | Chemistry of Colloid | 4 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6052 | Computational Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6054 | Coordination Chemistry | 5 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6056 | Capita Selecta in Inorganic Chemistry | 3 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6058 | Inorganic Synthesis | 7 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6060 | Sensors and Biosensors | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |

| | | | | | |
|---|---|---|---|---|---|
| SMKM6062 | Chemometrics | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6064 | Advanced Separation Techniques | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6066 | Environmental Impact Assessment | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6068 | Waste Treatment | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6070 | Organic Stereo Chemistry | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6072 | Secondary Metabolite Analysis | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6074 | Microbiology | 1 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6076 | Fermentation Technology | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6078 | Biotechnology | 2 | 5.6 Hours/week x 16 = 90 / 45.28 = 2 SKS | | 2 |
| SMKM6080 | Practicum of Environmental Impact Assessment | 1 | | 2,73 hours/week x x 16 = 43,68/45.28 = 1 SKS | 1 |
| SMPA6001 | Entrepreneurial Practice | 1 | | 47,6 Hours/week x 16 = 761,6/45.28 = 17 SKS | 17 |
| SMPA6002 | Scientific Publication | 2 | | 30,8 Hours/week x 16 = 492,8 / 45.28 = 11 SKS | 11 |
| SMPA6003 | Industrial Internship A | 1 | | 47,6 Hours/week x 16 = 761,6 / 45.28 = 17 SKS | 17 |
| SMPA6004 | Industrial Internship B | 1 | | 30,8 Hours/week x 16 = 492,8 / 45.28 = 11 SKS | 11 |
| SMPA6005 | Village Project A | 1 | | 50,4 Hours/week x 16 = 806,4 / 45.28 = 18 SKS | 18 |
| SMPA6006 | Village Project B | 1 | | 33,6 Hours/week x 16 = 537,6 / 45.28 = 12 SKS | 12 |

| | | | | | |
|---|---|---|---|---|---|
| SMPA6007 | Science Teaching Practice A | 3 | | 44,8 Hours/week x 16 = 716,8 / 45.28 = 16 SKS | 16 |
| SMPA6008 | Science Teaching Practice B | 3 | | 33,6 Hours/week x 16 = 537,6 / 45.28 = 12 SKS | 12 |

The development of courses was carried out by analyzing the interrelation between Intended Learning outcomes (ILO), subject matter, and Course Learning Outcomes (CLO). Based on the matrix that connects these three components, the list of courses and their respective credit weights (Ind.: SKS) was determined.

Table 3.4. Correlation between Course Learning Outcomes (CLO) and Courses

| CLO Code | CLO description | Course Code | Course Name |
|---|---|---|---|
| MKWKW01 | Explain the concept of the state and system of government, national identity, and analyze citizenship issues by demonstrating humanistic attitudes, integrity, appreciation for diversity, and the ability to collaborate and communicate effectively. | MKWU1002 | Civic Education |
| MKWKW02 | Analyze social problems by applying democratic and constitutional values in civic and national contexts, while embodying the University's core values. | MKWU1002 | Civic Education |
| MKWKW03 | Explain politics and the citizenship system, and apply the concepts of human rights and anti-corruption in daily interactions, demonstrating teamwork and effective communication to promote peace, justice, and strong institutions. | MKWU1002 | Civic Education |
| MKWKW04 | Analyze the implementation of the Indonesian Archipelagic Perspective (*Wawasan Nusantara*) and national resilience concepts to promote peace, justice, and institutional strength. | MKWU1002 | Civic Education |
| MKWUL01 | Demonstrate positive and responsible behavior related to disaster risk reduction and environmental sustainability within the context of course learning. | MKWU1005 | Disaster Management And Environment |

| | | | |
|---|---|---|---|
| MKWUL02 | Make appropriate decisions based on data and information analysis to solve problems within their field of expertise, integrated into course learning. | MKWU1005 | Disaster Management And Environment |
| MKWUL03 | Design a simple contingency plan as a crucial step in disaster preparedness, applied within the context of course learning. | MKWU1005 | Disaster Management And Environment |
| MKWUL04 | Design a simple project aimed at preventing environmental damage and enhancing environmental sustainability, integrated into course learning. | MKWU1005 | Disaster Management And Environment |
| MKWUPK1 | Demonstrate religious values and spiritual character, and be able to recognize and recite *Qur'anic* verses through the integrated *Iqra* learning method | MKWU1006 | Character Building 1 |
| MKWKP01 | Exhibit ways of thinking, attitudes, and actions that reflect the implementation of *Pancasila* values in community, national, and state life. | MKWU1001 | Pancasila |
| MKWKP02 | Identify and solve social and community problems based on ethical and moral values derived from Pancasila. | MKWU1001 | Pancasila |
| MKWKP03 | Demonstrate attitudes and behavior consistent with the values of *Pancasila*. | MKWU1001 | Pancasila |

| | | | |
|---|---|---|---|
| MKWKP04 | Make appropriate decisions as alternative solutions to various problems in community, national, and state life in accordance with the principles and values of Pancasila. | MKWU1001 | Pancasila |
| MKWKI01 | Explain the essence, position, function, and attitude of using the Indonesian language appropriately. | MKWU1003 | Indonesian Language |
| MKWKI02 | Apply correct spelling, diction, affixation, reduplication, and composition in Indonesian writing. | MKWU1003 | Indonesian Language |
| MKWKI03 | Construct grammatically correct sentences, and compose and develop coherent paragraphs in Indonesia. | MKWU1003 | Indonesian Language |
| MKWKI04 | Write formal letters, academic papers, and various types of technical reports in proper and correct Indonesian. | MKWU1003 | Indonesian Language |
| MKWUN01 | Demonstrate understanding of TOEFL concepts related to listening comprehension skills. | MKWU1004 | English |
| MKWUN02 | Demonstrate understanding of TOEFL concepts related to reading comprehension skills. | MKWU1004 | English |
| MKWUN03 | Demonstrate understanding of TOEFL concepts related to structural and written expression components. | MKWU1004 | English |
| MKWUN04 | Practice integrated communication and speaking skills within the TOEFL framework. | MKWU1004 | English |

| | | | |
|---|---|---|---|
| MKWUPK2 | Demonstrate a strong religious character and spirit, and express them through appropriate attitudes and ethical behavior, in alignment with USK's institutional values and the implementation of Islamic law (*Syariat Islam*) in Aceh. | MKWU1007 | Character Building 2 |
| MKWUPK3 | Demonstrate understanding and proper practice of worship as an expression of true Islamic faith in accordance with the *Qur'an* and *Sunnah*. | MKWU1007 | Character Building 2 |
| MKWKA01 | Analyze the scope and identify the creation of humankind and the universe from both Islamic and scientific perspectives through appropriate problem-solving approaches. | MKWU2001 | Religion Education |
| MKWKA02 | Explain the framework of Islamic teachings—including *aqidah* (Islamic belief system), ethics, sources of Islamic law (*Qur'an, Hadith, ijtihad*), and the application of Islamic Law within the campus environment—along with the relevance of the *Qanun* (Islamic local regulations) and family development in Islam, and resolve contextual issues appropriately. | MKWU2001 | Religion Education |

| | | | |
|---|---|---|---|
| MKWKA03 | Analyze concepts of *muamalah* based on contemporary *fiqh muamalah*, the principles of Islam as a discipline, and apply Islamic manners in social interactions, dress code, and modesty appropriately. | MKWU2001 | Religion Education |
| MKWKA04 | Analyze *fiqh mawaris* (Islamic inheritance law), the urgency of addressing proxy wars and strategies to respond to them appropriately, and internalize the principle of *istiqamah* (steadfastness) in the implementation of mental revolution based on Islamic values comprehensively. | MKWU2001 | Religion Education |
| MKWKN01 | Demonstrate the ability to identify community problems, design, and develop community empowerment programs for rural areas based on disciplinary knowledge, skills, and general competencies (proposal development). | MKWUP001 | Community Service Program |
| CPMKM01 | Explain and determine fundamental concepts in mathematics, including real numbers, exponents and roots, logarithms, algebraic and rational forms, equations, inequalities, absolute values, and coordinate systems. | SMPA1001 | Introduction to Calculus |
| CPMKM02 | Explain basic concepts of functions and determine related aspects such as limits and continuity of functions [C2, C3] | SMPA1001 | Introduction to Calculus |

| | | | |
|---|---|---|---|
| CPMKF01 | Explain and solve problems related to units, quantities, vectors, and kinematics (motion in one, two, and three dimensions). | SMPA1003 | Introduction to Physics |
| CPMKF02 | Explain and solve problems related to dynamics (force, pressure, and energy). | SMPA1003 | Introduction to Physics |
| CPMKF03 | Explain and solve problems related to dynamics (momentum and center of mass). | SMPA1003 | Introduction to Physics |
| CPMKF04 | Explain and solve problems related to simple harmonic motion. | SMPA1003 | Introduction to Physics |
| CPMKF05 | Explain and solve problems related to rotation, rigid bodies, elasticity, and gravitation. | SMPA1003 | Introduction to Physics |
| CPMKF06 | Explain and solve problems related to fluid mechanics. | SMPA1003 | Introduction to Physics |
| CMPKK01 | Explain fundamental concepts of atoms, molecules, molecular orbitals, chemical bonding, the periodic system, and element properties. | SMPA1005 | Introduction to Chemistry |
| CMPKK02 | Explain concepts and perform calculations related to the fundamental principles of chemistry. | SMPA1005 | Introduction to Chemistry |
| CPMKW71 | Study and describe the structure, function, and metabolism of cells. | SMPA1007 | Introduction to Biology |
| CPMKW72 | Study and describe both classical and modern genetics. | SMPA1007 | Introduction to Biology |
| CPMKW73 | Study and describe the structure and function of plant and animal organs. | SMPA1007 | Introduction to Biology |

| | | | |
|---|---|---|---|
| CPMKW74 | Describe and identify the fundamental principles of ecology and the biosystematics of living organisms. | SMPA1007 | Introduction to Biology |
| CPMKI01 | Understand the core concepts and technologies underlying the Fourth Industrial Revolution (Industry 4.0) | SMPA1009 | Introduction to Industrial Revolution |
| CPMKI02 | Analyze the impact of Industry 4.0 on various economic, social, and environmental aspects. | SMPA1009 | Introduction to Industrial Revolution |
| CPMKI03 | Develop students' digital competencies and innovative abilities in relevant contexts. | SMPA1009 | Introduction to Industrial Revolution |
| CPMK02 | Demonstrate proficiency in conducting laboratory procedures, operating basic physics instruments, applying safety and security standards, and managing materials, equipment, and laboratory operations. | SMPA1021 | Practicum of Introduction to Physics |
| CPMK011 | Demonstrate independent laboratory skills and the ability to operate laboratory instruments (e.g., microscopes) effectively. | SMPA1017 | Practicum of Introduction to Biology |
| CPMK012 | Observe, analyze, and describe the structure and function of cells. | SMPA1017 | Practicum of Introduction to Biology |
| CPMK013 | Understand and explain recessive gene frequencies. | SMPA1017 | Practicum of Introduction to Biology |
| CPMK014 | Observe, analyze, tabulate, and describe the structure and function of living organisms. | SMPA1017 | Practicum of Introduction to Biology |
| CPMKS01 | Understand fundamental mathematical concepts relevant to statistical science. | SMPAP001 | Statistical Methods |

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| CPMKS02 | Explain core concepts, theories, and frameworks underlying data and statistical analysis. | SMPAP001 | Statistical Methods |
| CPMKU01 | Analyze the fundamental principles of entrepreneurship. | SMPA3013 | Entrepreneurship |
| CPMKU02 | Apply foundational concepts of science and applied sciences in entrepreneurship. | SMPA3015 | Practicum of Entrepreneurship |
| CPMKU03 | Explain the principles of management in industrial, corporate, or public/private institutions. | SMPAP001 | Internship |
| CPMKU04 | Conduct practical work or internships in industries or institutions relevant to the field of study. | SMPAP001 | Internship |
| CPMKU05 | Design, report, and explain research plans in accordance with scientific principles. | SMPAP002 | Research Proposal |
| CPMKU06 | Conduct, report, and disseminate research outcomes in the undergraduate thesis defense. | SMPAPA01 | Final Project |
| CPMKU07 | Carry out entrepreneurial activities based on adaptive concepts and ICT-based marketing strategies. | SMPA6001 | Entrepreneurial Practice |
| CPMKU08 | Produce scientific publications in reputable international journals as the corresponding or lead author. | SMPA6002 | Scientific Publication |
| CPMKU09 | Understand and engage in professional activities within industries or institutions relevant to the field of study, and prepare written reports and oral presentations. | SMPA6003 | Industrial Internship A |

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| CPMKU10 | Understand and engage in professional activities within industries or institutions relevant to the field of study, and prepare written reports and oral presentations. | SMPA6004 | Industrial Internship B |
| CPMKU11 | Conduct microteaching sessions at the elementary or junior high school level and assist in basic science practicum activities at the secondary school level. | SMPA6007 | Science Teaching Practice A |
| CPMKU12 | Conduct microteaching sessions at the elementary or junior high school level and assist in basic science practicum activities at the secondary school level. | SMPA6008 | Science Teaching Practice B |
| CPMKU13 | Adapt, collaborate, communicate, and build networks while assisting in village development programs through science and technology applications in partnership with community stakeholders to enhance local potential and economy. | SMPA6005 | Village Project A |
| CPMKU14 | Adapt, collaborate, communicate, and build networks while assisting in village development programs through science and technology applications in partnership with community stakeholders to enhance local potential and economy. | SMPA6006 | Village Project B |
| CPPS01 | Explain concepts of atoms, molecules, molecular orbitals, chemical bonding, periodic systems, elemental properties, gas laws, matter behavior, colligative properties, | SMKM1002 | Basic Chemistry |

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| | colloidal states, acid–base theory, redox and electrochemistry, basic thermochemistry and thermodynamics, solubility and solubility products, basic chemical kinetics, and nuclear chemistry. | | |
| CPPS02 | Perform calculations related to the fundamentals of chemistry, including stoichiometry, gas laws, solubility products, kinetics, and nuclear chemistry. | SMKM1002 | Basic Chemistry |
| CPPS03 | Demonstrate laboratory competence by performing chemical experiments, operating basic laboratory instruments, applying safety standards, and managing chemical materials, equipment, and facilities. | SMKM1010 | Laboratory Management |
| | | SMPA1019 | Practicum of Introduction to Chemistry |
| | | SMKM1004 | Practicum of Basic Chemistry |
| CPPS04 | Apply foundational concepts of mathematics, physics, biology, entrepreneurship, and related sciences in the field of chemistry. | SMKM1006 | Scientific Mathematics |
| | | SMKM1008 | Fundamental of Physics |
| CPPS05 | Explain industrial management and chemical process operations. | SMKM6046 | Industrial Chemistry |
| CPPS06 | Conduct literature reviews using recent reputable scientific journals, translate and write in scientific formats, and present findings in academic forums. | SMKM3042 | Colloquium |
| CPPS07 | Design, report, and explain research proposals in accordance with scientific standards. | SMKM3040 | Research Methodology |

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| CPPS09 | Produce chemical-based products derived from chemical knowledge or skills with potential for commercialization. | SMKM6076 | Fermentation Technology |
| CPKF01 | Explain the properties of gases and the applications of gas laws | SMKM2005 | Physical Chemistry I |
| | | SMKM2003 | Practicum of Physical Chemistry I |
| CPKF02 | Explain and calculate basic concepts in chemical thermodynamics | SMKM2005 | Physical Chemistry I |
| CPKF03 | Explain and calculate fundamental concepts of chemical equilibrium | SMKM2005 | Physical Chemistry I |
| CPKF04 | Explain the basic principles of mass and heat transfer in gaseous and liquid phases | SMKM2012 | Physical Chemistry II |
| | | SMKM2014 | Practicum of Physical Chemistry II |
| CPKF05 | Explain and calculate basic concepts in chemical thermodynamics | SMKM2012 | Physical Chemistry II |
| | | SMKM6039 | Electrochemistry |
| CPKF06 | Explain fundamental concepts of chemical kinetics in gas-phase and solution-phase reactions. | SMKM2012 | Physical Chemistry II |
| CPKF07 | Explain and calculate basic concepts in quantum chemistry | SMKM3023 | Physical Chemistry III |
| CPKF08 | Explain the fundamental principles of electronic transitions in molecules | SMKM3023 | Physical Chemistry III |
| | | SMKM6047 | Radiation Chemistry |
| CPKF09 | Explain basic chemical bonding concepts using VSEPR and Molecular Orbital Theory (MOT). | SMKM3023 | Physical Chemistry III |
| CPKF10 | Differentiate between solutions and colloidal systems<br>Explain physicochemical phenomena at chemical interfaces | SMKM3032 | Physical Chemistry IV |
| | | SMKM6050 | Chemistry of Colloid |
| CPKF11 | Explain the types and | SMKM3032 | Physical Chemistry IV |

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|---|---|---|---|
| | properties of solids<br>Explain basic chemical bonding concepts using VSEPR and Molecular Orbital Theory (MOT). | | |
| | | SMKM6043 | Surface Chemistry |
| CPKF12 | Differentiate between solutions and colloidal systems<br>Explain physicochemical phenomena at chemical interfaces | SMKM3032 | Physical Chemistry IV |
| | | SMKM6044 | Solid State Chemistry |
| CPKF13 | Explain the types and properties of solids | SMKM6041 | Material Chemistry |
| CPKF14 | Master theoretical concepts and fundamental principles of industrial chemistry<br>Master the basic principles of energy sources and product testing | SMKM6041 | Industrial Chemistry |
| CPKF15 | Master theoretical concepts of macromolecules, including identification, characterization, and analytical methods | SMKM6045 | Petroleum Chemistry |
| CPKF16 | Master theoretical concepts and fundamental principles of industrial chemistry | SMKM6046 | Polymer Chemistry |
| CPKF17 | Master the fundamental principles of software tools for molecular analysis, synthesis, and modeling of specific chemical systems. | SMKM6048 | Computational Chemistry |
| CPKF18 | Master theoretical concepts related to the structure, properties, and transformations of chemical systems—including energy and kinetic aspects—along with identification, separation, characterization, transformation, and | SMKM6050 | Material Chemistry |

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| | synthesis of micromolecular compounds and their applications. | | |
| CPAN01 | Explain the terminology and nomenclature systems of inorganic compounds. | SMKM2016 | Inorganic Chemistry II |
| CPAN02 | Explain the relationship between the properties of elements and the compounds they form, in correlation with periodic trends. | SMKM2009 | Inorganic Chemistry I |
| CPAN03 | Explain the characteristics of inorganic materials and the theories used to describe them. | SMKM2009 | Inorganic Chemistry I |
| CPAN04 | Predict the stability of inorganic compounds based on the Hard and Soft Acids and Bases (HSAB) concept. | SMKM2016 | Inorganic Chemistry II |
| | | SMKM3025 | Inorganic Chemistry III |
| | | SMKM6054 | Coordination Chemistry |
| CPAN05 | Explain the fundamental principles, procedures, and characterization techniques of inorganic compounds | SMKM3025 | Inorganic Chemistry III |
| | | SMKM3027 | Practicum of Inorganic Chemistry III |
| | | SMKM6058 | Inorganic Synthesis |
| | | SMKM6051 | Catalysts |
| | | SMKM6056 | Capita Selecta in Inorganic Chemistry |
| CPAN06 | Explain the basic concepts of quantum mechanics and their applications in describing the structure and properties of atoms and molecules | SMKM2009 | Inorganic Chemistry I |
| | | SMKM3025 | Inorganic Chemistry III |
| CPAN07 | Explain thermodynamic concepts and their applications in inorganic | SMKM2016 | Inorganic Chemistry II |

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| | chemistry. | SMKM3027 | Practicum of Inorganic Chemistry III |
| CPAN08 | Explain the principles of kinetics and the mechanisms of inorganic chemical reactions. | SMKM3025 | Inorganic Chemistry III |
| | | SMKM6049 | Bioinorganic Chemistry |
| CPAN09 | Analyze and interpret UV, IR, XRD, and NMR spectral data to determine the structures of inorganic compounds | SMKM6056 | Capita Selecta in Inorganic Chemistry |
| | | SMKM6058 | Inorganic Synthesis |
| | | SMKM6054 | Coordination Chemistry |
| | | SMKM3034 | Organometallics |
| | | SMKM6053 | Mineralogy |
| CPAN10 | Explain the properties and effects of ligands on inorganic compound reactions. | SMKM2018 | Practicum of Inorganic Chemistry II |
| | | SMKM3025 | Inorganic Chemistry III |
| | | SMKM6054 | Coordination Chemistry |
| | | SMKM6051 | Catalysts |
| | | SMKM3034 | Organometallics |
| | | SMKM6049 | Bioinorganic Chemistry |
| | | SMKM6058 | Inorganic Synthesis |
| | | SMKM6054 | Coordination Chemistry |
| | | SMKM6049 | Bioinorganic Chemistry |
| CPAN11 | Explain the structure and reactivity of important bioinorganic molecules and the chemical aspects of biological processes. | SMKM3025 | Inorganic Chemistry III |
| | | SMKM6049 | Bioinorganic Chemistry |
| CPAN12 | Explore and utilize local natural resources for synthesis and chemical reactions in inorganic chemistry. | SMKM6058 | Inorganic Synthesis |
| | | SMKM6053 | Mineralogy |
| | | SMKM6056 | Capita Selecta in Inorganic Chemistry |
| CPAL01 | Explain the basic concepts of analytical chemistry, perform qualitative analyses, and calculate | SMKM2011 | Analytical Chemistry I |
| | | SMKM2013 | Practicum of Analytical Chemistry I |

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| | quantitative analytical results accurately. | SMKM2020 | Analytical Chemistry II |
| | | SMKM2022 | Practicum of Analytical Chemistry II |
| | | SMKM3029 | Instrumentation Analysis |
| | | SMKM3031 | Practicum of Instrumentation Analysis |
| CPAL02 | Explain the fundamental concepts and operate basic or conventional analytical instruments. | SMKM1003 | Principle of Separation Methods |
| | | SMKM2020 | Analytical Chemistry II |
| CPAL03 | Collect instrumental analysis data, process, analyze, interpret, and validate measurement results. | SMKM2011 | Analytical Chemistry I |
| | | SMKM3029 | Instrumentation Analysis |
| | | SMKM3031 | Practicum of Instrumentation Analysis |
| | | SMKM6062 | Chemometrics |
| CPAL04 | Explain the fundamental concepts and applications of chemical separation, and perform separation procedures | SMKM1003 | Principle of Separation Methods |
| | | SMKM2011 | Analytical Chemistry I |
| | | SMKM6064 | Advanced Separation Techniques |
| | | SMKM6061 | Introduction of Chromatography |
| CPAL05 | Explain the basic principles and applications of chemical and biosensor analysis, and perform relevant analytical measurements. | SMKM6055 | Applied Analytical Chemistry |
| | | SMKM6060 | Sensor Kimia & Biosensor |
| CPAL06 | Explain the basic concepts, mechanisms, and applications of chromatography, including key parameters affecting chemical separation. | SMKM3029 | Instrumentation Analysis |
| | | SMKM6061 | Introduction of Chromatography |
| | | SMKM6064 | Advanced Separation Techniques |
| CPAL07 | Explain fundamental concepts and interpret data obtained from various modern analytical | SMKM6055 | Applied Analytical Chemistry |
| | | SMKM6062 | Chemometrics |

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|---|---|---|---|
| | techniques. | SMKM6059 | Chemical Analysis of Halal Products |
| CPAL08 | Explain the parameters, sources, processes, and analytical methods used in environmental pollution analysis. | SMKM6055 | Applied Analytical Chemistry |
| | | SMKM6068 | Waste Treatment |
| | | SMKM6057 | Environmental Chemistry |
| CPAL09 | Identify the chemical impacts of development activities on the environment. | SMKM6066 | Environmental Impact Assesment |
| | | SMKM6068 | Waste Treatment |
| | | SMKM6057 | Environmental Chemistry |
| | | SMKM6080 | Practicum of Environmental Impact Assesment |
| CPOR01 | Explain the terminology and nomenclature systems of organic compounds. | SMKM2015 | Organic Chemistry I |
| | | SMKM2024 | Organic Chemistry II |
| CP.OR02 | Explain the relationships between functional groups, molecular structure, physicochemical properties, and the behavior of functional groups in organic molecules. | SMKM2015 | Organic Chemistry I |
| | | SMKM2017 | Practicum of Organic Chemistry I |
| | | SMKM2024 | Organic Chemistry II |
| | | SMKM2026 | Practicum of Organic Chemistry II |
| CPOR03 | Explain the concepts of stereochemistry in organic molecules. | SMKM2015 | Organic Chemistry I |
| | | SMKM6070 | Organic Stereo Chemistry |
| | | SMKM3036 | Organic Chemistry of Natural Product |
| | | SMKM6063 | Introduction to Organic Synthesis |
| CPOR04 | Predict acid–base strength based on molecular structure and chemical environment. | SMKM2015 | Organic Chemistry I |
| CPOR05 | Predict the types and mechanisms of organic reactions based on reactants, reagents, kinetics, and reaction | SMKM2024 | Organic Chemistry II |
| | | SMKM3033 | Organic Chemistry III |
| | | SMKM6063 | Introduction to Organic |

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|---|---|---|---|
| | conditions. | | Synthesis |
| CPOR06 | Explain the fundamental principles, procedures, and characterization techniques of organic compounds. | SMKM6072 | Secondary Metabolite Analysis |
| | | SMKM3035 | Structure Elucidation of Organic Compounds |
| CPOR07 | Analyze and interpret UV, IR, MS, and NMR spectral data to determine the structures of organic compounds. | SMKM3035 | Structure Elucidation of Organic Compounds |
| CPOR08 | Analyze the properties of aliphatic, aromatic, heterocyclic, and organometallic compounds. | SMKM2024 | Organic Chemistry II |
| | | SMKM3033 | Organic Chemistry III |
| CPOR09 | Perform synthesis and analyze biosynthetic pathways of organic compounds. | SMKM3036 | Organic Chemistry of Natural Product |
| CPOR10 | Identify secondary metabolites based on their properties, reactions, and applications. | SMKM6072 | Secondary Metabolite Analysis. |
| | | SMKM3036 | Organic Chemistry of Natural Product |
| CPOR11 | Conduct bioactivity tests on secondary metabolite products. | SMKM6065 | Basic Bioassay Technology |
| CPBI01 | Explain the principles and apply procedures for the isolation, analysis, identification, and characterization of biomolecules. | SMKM2021 | Practicum of Biochemistry I |
| | | SMKM2030 | Practicum of Biochemistry II |
| | | SMKM6047 | Microbiology |
| CPBI02 | Explain the principles and methodologies for biomolecular analysis and characterization using chromatography, spectrophotometry, high-resolution imaging, and crystallographic analysis. | SMKM3038 | Biochemistry Research Techniques |
| CPBI03 | Explain the basic concepts of bioenergetics. | SMKM2019 | Biochemistry I |

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| CPBI04 | Explain the concepts, mechanisms, and calculations of enzyme kinetics and interpret the results. | SMKM2019 | Biochemistry I |
| | | SMKM2021 | Practicum of Biochemistry I |
| CPBI05 | Explain the principles and procedures of DNA amplification, DNA and protein sequencing, and visualize the results using electrophoresis. | SMKM3038 | Biochemistry Research Techniques |
| CPBI06 | Explain the principles, pathways, and regulation of biomolecular metabolism (carbohydrates, lipids, nucleic acids, and proteins) | SMKM2028 | Biochemistry II |
| CPBI07 | Explain the relationships between monomeric and polymeric properties of biomolecules (carbohydrates, lipids, nucleic acids, and proteins). | SMKM2019 | Biochemistry I |
| | | SMKM2028 | Biochemistry II |
| CPBI08 | Explain the structure, function, and metabolism of biomolecules (carbohydrates, lipids, nucleic acids, and proteins). | SMKM2019 | Biochemistry I |
| | | SMKM2028 | Biochemistry II |
| CPBI09 | Explain the relationships between metabolic disorders and diseases. | SMKM3037 | Biochemistry III |
| | | SMKM6071 | Medicinal Chemistry |
| CPBI10 | Explain the mechanisms of genetic information translation, regulation, engineering, and their applications. | SMKM3037 | Biochemistry III |
| | | SMKM6078 | Biotechnology |
| CPBI11 | Apply biochemical principles and multidisciplinary methods to address issues in food, energy, and health. | SMKM6069 | Food Chemistry |
| | | SMKM6071 | Medicinal Chemistry |
| | | SMKM6076 | Fermentation Technology |
| | | SMKM6078 | Biotechnology |
| | | SMKM6074 | Microbiology |

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|---|---|---|---|
| CPBI12 | Utilize, process, and interpret biomolecular databases. | SMKM6067 | Bioinformatics |
| | | SMKM6071 | Medicinal Chemistry |

The established courses are then analyzed based on their relevance to the Intended Learning Outcomes (ILOs). This analysis is conducted to determine the extent to which each course contributes to the achievement of the ILOs, thereby ensuring that the assessment of learning outcomes can be accurately measured. Table 3.5 presents the correlation between the courses and the Programme Learning Outcomes (ILOs).

Table 3.5. Alignment between university courses and the Intended Learning Outcomes (ILOs)

| Course Code | Course Title | ILO Code | | | | | |
|---|---|---|---|---|---|---|---|
| | | ILO01 | ILO02 | ILO03 | ILO04 | ILO05 | ILO 001 |
| MKWU1002 | Civic Education | √ | | | | | |
| MKWU1005 | Disaster Management and Environment | √ | | | | | |
| MKWU1006 | Character Building I | | | | | | √ |
| MKWU1001 | Pancasila | √ | | | | | |
| MKWU1003 | Indonesian Language | √ | | | | | |
| MKWU1004 | English | √ | | | | | |
| MKWU1007 | Character Building 2 | √ | | | | | |
| MKWU2001 | Religion Education | √ | | | | | |
| MKWUP001 | Community Service Program | √ | | | | | |

Table 3.6. Alignment between the courses of the Faculty of Mathematics and Natural Sciences and the Intended Learning Outcomes (ILOs)

| Course Code | Course Title | ILO Code | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ILO 01 | ILO 02 | ILO 03 | ILO 04 | ILO 05 | ILO F02 | ILO K02 | ILO K03 | ILO K05 | ILO B02 | ILO I05 | ILO S01 | ILO S02 | ILO W01 | ILO W02 | ILO W03 | ILO W05 |
| SMPA1001 | Introduction to Calculus | | √ | | | | | | | | | | | | | | | |
| SMPA1003 | Introduction to Physics | | | | | | √ | | | | | | | | | | | |
| SMPA1005 | Introduction to Chemistry | | | | | | | √ | √ | √ | | | | | | | | |
| SMPA1007 | Introduction to Biology | | | | | | | | | | √ | | | | | | | |
| SMPA1009 | Introduction to Industrial | | | | | | | | | | | √ | | | | | | |

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| | Revolution | | | | | | | | | | | | | | | | | |
| SPHY1001 | Practicum of Introduction to Physics | √ | | | | | | | | | | | | | | | | |
| SMBI1001 | Practicum of Introduction to Biology | | | | | | | | | | √ | | | | | | | |
| SMPA1011 | Statistical Methods | | | | | | | | | | | | √ | √ | | | | |
| SMPA3013 | Entrepreneurship | | | | | | | | | | | | | | √ | √ | √ | √ |
| SMPA3015 | Practicum of Entrepreneurship | | | | | | | | | | | | | | √ | | | |
| SMPAP001 | Internship | | | | | √ | | | | | | | | | | | | |
| SMPAP002 | Research Proposal | | | | √ | √ | | | | | | | | | | | | |
| SMPAPA01 | Final Project | √ | √ | √ | √ | √ | | | | | | | | | | | | |
| SMPA6001 | Entrepreneurial Practice | √ | √ | | | | | | | | | | | | | | | |
| SMPA6002 | Scientific Publication | | √ | | | √ | | | | | | | | | | | | |
| SMPA6003 | Industrial Internship A | | √ | | √ | √ | | | | | | | | | | | | |
| SMPA6004 | Industrial Internship B | | √ | | √ | √ | | | | | | | | | | | | |
| SMPA6005 | Village Project A | √ | √ | | | | | | | | | | | | | | | |
| SMPA6006 | Village Project B | √ | √ | | | | | | | | | | | | | | | |
| SMPA6007 | Science Teaching Practice A | | √ | | √ | | | | | | | | | | | | | |
| SMPA6008 | Science Teaching Practice B | | √ | | √ | | | | | | | | | | | | | |

Table 3.7. Alignment between the Department of Chemistry courses and the Intended Learning Outcomes (ILOs)

| Course Code | Course Title | ILO Code | | | | |
|---|---|---|---|---|---|---|
| | | ILO01 | ILO02 | ILO03 | ILO04 | ILO05 |
| SMKM1001 | Practicum of Introduction to Chemistry | | | √ | | |
| SMKM1003 | Principle of Separation Methods | √ | √ | | √ | √ |
| SMKM1002 | Basic Chemistry | | | | | √ |

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|---|---|---|---|---|---|---|
| SMKM1004 | Practicum of Basic Chemistry | | | √ | | |
| SMKM1006 | Scientific Mathematics | | | | | √ |
| SMKM1008 | Fundamental of Physics | | | | | √ |
| SMKM1010 | Laboratory Management | | | √ | | |
| SMKM2005 | Physical Chemistry I | | | | | √ |
| SMKM2007 | Practicum of Physical Chemistry I | | | √ | | |
| SMKM2009 | Inorganic Chemistry I | | | | | √ |
| SMKM2011 | Analytical Chemistry I | √ | | | | √ |
| SMKM2013 | Practicum of Analytical Chemistry I | | | √ | | |
| SMKM2015 | Organic Chemistry I | | √ | | | √ |
| SMKM2017 | Practicum of Organic Chemistry I | | | √ | | |
| SMKM2019 | Biochemistry I | | | | | √ |
| SMKM2021 | Practicum of Biochemistry I | | | √ | | |
| MKWU2001 | Religion Education | √ | √ | | | |
| SMKM2012 | Physical Chemistry II | | | | | √ |
| SMKM2014 | Practicum of Physical Chemistry II | | | √ | | |
| SMKM2016 | Inorganic Chemistry II | | | | | √ |
| SMKM2018 | Practicum of Inorganic Chemistry II | | | √ | | |
| SMKM2020 | Analytical Chemistry II | √ | | | | √ |
| SMKM2022 | Practicum of Analytical Chemistry II | | | √ | | |
| SMKM2024 | Organic Chemistry II | | √ | | | √ |
| SMKM2026 | Practicum of Organic Chemistry II | | | √ | | |
| SMKM2028 | Biochemistry II | | | | | √ |
| SMKM2030 | Practicum of Biochemistry II | | | √ | | |
| SMKM3023 | Physical Chemistry III | | | | | √ |
| SMKM3025 | Inorganic Chemistry III | | | | | √ |
| SMKM3027 | Practicum of Inorganic Chemistry III | | | | √ | |
| SMKM3029 | Instrumentation Analysis | √ | | | | √ |
| SMKM3031 | Practicum of Instrumentation Analysis | √ | √ | √ | | √ |
| SMKM3033 | Organic Chemistry III | | √ | | | √ |
| SMKM3035 | Structure Elucidation of Organic | | | √ | | √ |
| SMKM3037 | Biochemistry III | | | | | √ |
| SMKM3032 | Physical Chemistry IV | | | | | √ |

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|---|---|---|---|---|---|---|
| SMKM3034 | Organometallics | | √ | | | √ |
| SMKM3036 | Organic Chemistry of Natural Product | √ | √ | | | √ |
| SMKM3038 | Biochemistry Research Techniques | | | | | √ |
| SMKM3040 | Research Methodology | | | | | √ |
| SMKM3042 | Colloquium | | | | √ | √ |
| SMKM6039 | Electrochemistry | | | | | √ |
| SMKM6041 | Material Chemistry | | | | | √ |
| SMKM6043 | Surface Chemistry | | | | | √ |
| SMKM6045 | Petroleum Chemistry | | | | | √ |
| SMKM6047 | Radiation Chemistry | | | | | √ |
| SMKM6049 | Bioinorganic Chemistry | √ | √ | | | √ |
| SMKM6051 | Catalysts | | | | √ | √ |
| SMKM6053 | Mineralogy | | √ | | | √ |
| SMKM6055 | Applied Analytical Chemistry | √ | √ | | √ | √ |
| SMKM6057 | Environmental Chemistry | √ | √ | | √ | √ |
| SMKM6059 | Chemical Analysis of Halal Products | √ | | √ | √ | √ |
| SMKM6061 | Introduction of Chromatography | | √ | √ | √ | |
| SMKM6063 | Introduction to Organic Synthesis | | | √ | | √ |
| SMKM6065 | Basic Bioassay Technology | | | √ | | √ |
| SMKM6067 | Bioinformatics | | √ | √ | | √ |
| SMKM6069 | Food Chemistry | | √ | √ | | √ |
| SMKM6071 | Medicinal Chemistry | | √ | √ | | √ |
| SMKM6044 | Solid State Chemistry | | | | | √ |
| SMKM6046 | Industrial Chemistry | | | | | √ |
| SMKM6048 | Polymer Chemistry | | | | | √ |
| SMKM6050 | Chemistry of Colloid | | | | | √ |
| SMKM6052 | Computational Chemistry | | | | | √ |
| SMKM6054 | Coordination Chemistry | | | | | √ |
| SMKM6056 | Capita Selecta in Inorganic Chemistry | | | | √ | √ |
| SMKM6058 | Inorganic Synthesis | | | | √ | √ |
| SMKM6060 | Sensors and Biosensors | | | | | √ |
| SMKM6062 | Chemometrics | | | | | √ |
| SMKM6064 | Advanced Separation Techniques | | √ | | √ | |

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|---|---|---|---|---|---|---|
| SMKM6066 | Environmental Impact Assessment | | | | | √ |
| SMKM6068 | Waste Treatment | | √ | | √ | |
| SMKM6070 | Organic Stereo Chemistry | | √ | | | |
| SMKM6072 | Secondary Metabolite Analysis | | | √ | | √ |
| SMKM6074 | Microbiology | | | √ | | √ |
| SMKM6076 | Fermentation Technology | | √ | | | √ |
| SMKM6078 | Biotechnology | | | | √ | √ |
| SMKM6080 | Practicum of Environmental Impact Assessment | | | | | √ |

To facilitate the development of the Semester Learning Plans (RPS), a description of each course in the Bachelor in Chemistry Program has been prepared (Table 3.8).

Table 3.8. Course Descriptions

| Code | Course Title | Course Description |
|---|---|---|
| MKWU1002 | Civic Education | This course is an introduction to the essence of Civics Education, covering national identity, national integration, the constitution, rights and obligations of the state and its citizens, law enforcement and human rights, democracy, national insight, anti-corruption awareness, and national resilience. |
| MKWU1005 | Disaster Management and Environment | This course teaches active roles in disaster risk reduction efforts and equips students with basic humanities skills to address disaster and environmental issues. |
| MKWU1006 | Character Building I | A non-credit course focusing on USK values, especially religious and local cultural values. |
| SMPA1001 | Introduction to Calculus | This course covers basic mathematical concepts such as real numbers, exponents and roots, logarithms, algebraic and rational forms, equations and inequalities, coordinate geometry and linear equations, as well as an introduction to functions, limits, and continuity as a foundation for calculus. |
| SMPA1003 | Introduction to Physics | This course covers fundamental physical concepts and laws, including quantities and units, measurement, linear and circular motion, force and pressure, Newton's Laws I–III, momentum, work and energy, fluid mechanics, and waves and vibrations. |
| SMPA1005 | Introduction to Chemistry | This course introduces the properties and changes of matter, atomic and molecular structure, periodic system and periodicity, stoichiometry, chemical bonding, chemical equilibrium, and solutions including concentration calculations. |
| SMPA1007 | Introduction to Biology | This course covers basic concepts and principles of biology, including the scientific method, scope of biology, cell structure and function, cellular reproduction and respiration, photosynthesis, classical and modern genetics, and the structure and function of plant and animal organs, biosystematics, and ecology. |
| SMPA1009 | Introduction to Industrial Revolution | This course introduces the concepts, technologies, and impacts of the Industrial Revolution 4.0, including artificial intelligence, IoT, CPMKud computing, big data, cyber security, augmented/virtual reality, society 5.0, automation, and simulation. The course discusses the challenges and opportunities of digital transformation and strategies to navigate it.. |
| SPHY1001 | Practicum of Introduction to Physics | This course provides hands-on practice in physical principles covered in Introduction to Physics, including measurements, motion, forces, Newton's Laws, momentum, energy, fluid mechanics, and waves. |
| SMKM1001 | Practicum of Introduction to | This course includes laboratory practices on equipment use, matter and its changes, chemical reactions, fundamental |

| Code | Course Title | Course Description |
|---|---|---|
| | Chemistry | chemical laws, periodic system, stoichiometry, bonding and structure, equilibrium, solutions, acids and bases, and mixture separation. |
| SMBI1001 | Practicum of Introduction to Biology | This course introduces laboratory-based learning in biology fundamentals, including scientific processes, cell structure and function, cell reproduction, respiration, photosynthesis, classical and modern genetics, organ systems, biosystematics, and biological applications. |
| SMKM1003 | Principle of Separation Methods | This course discusses conventional separation methods such as distillation, extraction, filtration, sedimentation, coagulation, evaporation, sublimation, and an introduction to traditional chromatography. |
| MKWU1001 | Pancasila | This course serves as a foundation for understanding and developing national ideology, covering the historical perspective, the role of Pancasila as the basis of the Republic of Indonesia, its philosophical and ethical systems, and its relevance in scientific development. |
| MKWU1003 | Indonesian Language | This course covers the development, function, and position of the Indonesian language; standard spelling; word formation; diction; sentence construction; paragraph development; academic and popular scientific writing; academic book comprehension; library usage; and official correspondence. |
| MKWU1004 | English | This course prepares students for TOEFL and academic English by integrating listening, reading, structure, written expression, and speaking skills. |
| MKWU1007 | Character Building II | A non-credit course focusing on USK values, particularly religious and local cultural values. |
| SMPA1011 | Statistical Methods | This course introduces basic statistical concepts and techniques including data collection, descriptive statistics, probability, probability distributions, inferential statistics, regression analysis, and experimental design with real-world applications. |
| SMKM1002 | Basic Chemistry | This course covers gas laws, states of matter, colligative properties, colloids, acid-base theories, redox and electrochemistry, basics of thermochemistry and chemical thermodynamics, solubility product, chemical kinetics, and nuclear chemistry. |
| SMKM1004 | Practicum of Basic Chemistry | This course provides laboratory practice covering gas laws, solubility product, colorimetric analysis, acid-base reactions, redox reactions, electrochemistry, chemical thermodynamics, and kinetics. |
| SMKM1006 | Scientific Mathematics | This course covers rules, symbols, numbers, coordinate systems, functions and graphs, scalars and vectors, matrices and determinants, mathematical applications in chemical |

| Code | Course Title | Course Description |
|---|---|---|
| | | formulas, logarithms, differential and integral calculus, and differential equations. |
| SMKM1008 | Fundamental of Physics | This course covers heat and temperature, thermal properties of matter, thermodynamics, electricity and magnetism, electromagnetic waves, optics, relativity theory, and atomic theory. |
| SMKM1010 | Laboratory Management | This course introduces lab safety and security (including handling hazardous chemicals and fire, detoxification), management of chemical material procurement and storage, basic laboratory design, and ISO/IEC 17025 accreditation. |
| SMKM2005 | Physical Chemistry I | This course covers: (1) gas properties including gas laws and the kinetic molecular theory of gases; (2) the first law of thermodynamics, covering maximum work, system enthalpy, heat capacity, internal energy, Joule-Thomson effect, Carnot heat engine and pump, thermochemistry; and (3) the second and third laws of thermodynamics, including the entropy of pure substances and mixtures, entropy in chemical reactions, free energy, chemical equilibrium, and phase equilibrium. |
| SMKM2007 | Practicum of Physical Chemistry I | This course involves practical sessions on thermodynamics and its application in chemistry, characteristics of various states of matter, and theories used to describe them, as well as types and characteristics of chemical reactions. |
| SMKM2009 | Inorganic Chemistry I | This course provides an in-depth discussion of atomic structure and energy quantization, chemical bonding and the various theories that explain these phenomena, the characteristics of compounds formed through chemical bonding, and an overview of the properties of main group and transition elements. |
| SMKM2011 | Analytical Chemistry I | This course covers basic concepts of chemical analysis, the analytical process, random and systematic errors, fundamentals of measurement techniques, significance tests, chemical calculations (concentration), acid-base and solution equilibria, cation and anion analysis. |
| SMKM2013 | Practicum of Analytical Chemistry I | This laboratory course includes basic measurement and error principles, calibration and validation of simple measuring instruments, cation and anion analysis, acid-base equilibria, and solubility product. |
| SMKM2015 | Organic Chemistry I | This course covers alkanes, alkenes, and alkynes, an introduction to stereochemistry, and functional groups (alcohols and ethers, aldehydes and ketones, carboxylic acids and their derivatives, and amines). |

| Code | Course Title | Course Description |
|---|---|---|
| SMKM2017 | Practicum of Organic Chemistry I | This course involves practical work in qualitative organic compound analysis, determination of purity and identity of organic molecules, purification techniques, common organic reactions, and functional group transformations (alcohols, aldehydes, ketones, amines, amides), esterification, and the iodoform test.. |
| SMKM2019 | Biochemistry I | This course introduces the basic concepts of bioenergetics and the relationship between monomer and polymer properties in biomolecules, focusing on nucleic acids and proteins. It also includes the structure, function, and metabolism of nucleic acids and proteins, enzyme activity and kinetics, and the role of buffers in cells. |
| SMKM2021 | Practicum of Biochemistry I | This course involves practical sessions on isolating, analyzing, identifying, and characterizing nucleic acids and proteins. Enzymatic reactions and interpretation of results are also covered. |
| MKWU2001 | Religion Education | This course focuses on developing critical thinking, analytical skills, and problem-solving abilities related to human nature and religion, core Islamic teachings, and broader Islamic insights. |
| SMKM2012 | Physical Chemistry II | This course covers transport processes in liquid and gas phases, transport numbers, thermal and electrical conductivity, liquid viscosity and diffusion coefficients, electrochemical cells and reactions, cell balancing, cell potential, types of electrodes, electric current, Gibbs free energy and other thermodynamic quantities, equilibrium constants, solubility, pH and pK measurements. It also includes chemical kinetics: reaction rate concepts, thermodynamic perspective, reaction order and molecularity, analytical solutions of rate laws, activation energy (Arrhenius equation), complex reaction types (reversible, consecutive, parallel, mixed), steady-state method, pseudo-first order, determinants, Laplace transformation, kinetics in solution and catalysis. |
| SMKM2014 | Practicum of Physical Chemistry II | This course includes practical sessions on the types and characteristics of chemical reactions, chemical kinetics including catalysis, interpretation of chemical reactions, and characterization of matter. |
| SMKM2016 | Inorganic Chemistry II | This course covers intermolecular forces and their influence on compound properties, thermodynamic aspects of reactions, redox reactions, the concept of hard and soft acids and bases (HSAB), molecular symmetry and point groups, nomenclature of coordination compounds, bonding theories in coordination chemistry, and isomerism in coordination complexes. |
| SMKM2018 | Practicum of | This practical course includes experiments on the chemical |

| Code | Course Title | Course Description |
|---|---|---|
| | Inorganic Chemistry II | properties of chlorine compounds, periodic trends in reactivity, preparation of hydrotalcite by the coprecipitation method, redox stability in aqueous systems, cation reactions, equilibria in coordination compounds, element extraction by reduction, and metal adsorption using various adsorbents. |
| SMKM2020 | Analytical Chemistry II | This course discusses quantitative analysis including gravimetric methods, all volumetric methods (acid-base titration, argentometric, complexometric, redox titration, potentiometry, conductometry), solvent extraction, distribution coefficients, and distribution ratios. |
| SMKM2022 | Practicum of Analytical Chemistry II | This laboratory course includes practicals on quantitative analysis using volumetric methods (acid-base titration, argentometric, complexometric, redox titration, potentiometry, conductometry), and gravimetric methods. |
| SMKM2024 | Organic Chemistry II | This course covers alkyl halides (intro to substitution and elimination reactions), organometallics (radical reactions), aromaticity (benzene and substituted benzenes), heteroaromatics and polycyclics, enolates and carbanions, and an introduction to pericyclic reactions.. |
| SMKM2026 | Practicum of Organic Chemistry II | This course includes practical sessions on recrystallization, distillation of monoterpenes from orange peel, preparation of wintergreen oil, synthesis of acetylsalicylic acid (aspirin), alkaloid extraction from plants, caffeine isolation from tea, electrophilic substitution reactions (e.g., picric acid synthesis), colorant identification using chromatography, and synthesis of isopropyl bromide. |
| SMKM2028 | Biochemistry II | This course explores the relationship between the properties of monomers and polymers in biomolecules, focusing on carbohydrates and lipids. It includes the structure, function, and metabolism of these biomolecules and their roles in ATP production. Photosynthetic ATP synthesis pathways are also discussed. |
| SMKM2030 | Practicum of Biochemistry II | This course involves laboratory work focused on isolating, analyzing, and identifying carbohydrates and lipids, as well as photosynthesis-related experiments. |
| SMKM3023 | Physical Chemistry III | This course introduces quantum chemistry, wave equations, Schrödinger's equation and its simple applications, free particles, particles in a box, hydrogen atom postulates, Pauli exclusion principle, Hund's rule, Aufbau principle; chemical bonding including ionic bonds, lattice structure and energy, Born-Haber cycle, covalent bonding, orbital overlap, valence bond (VB) and molecular orbital (MO) theory, coordination bonds, rotational spectroscopy, vibrational spectroscopy, and electronic transitions. |
| SMKM3025 | Inorganic Chemistry III | This course focuses on coordination compounds, including the electronic spectra of complexes, reaction types and |

| Code | Course Title | Course Description |
|---|---|---|
| | | mechanisms, synthesis and characterization of coordination compounds, photochemical reactions, and the role of inorganic compounds in biological systems. |
| SMKM3027 | Practicum of Inorganic Chemistry III | This laboratory course includes experiments on the synthesis of *cis*- and *trans*-$[Cr(C_2O_4)_2(H_2O)_2]\cdot H_2O$, preparation of iron(II) ammonium sulfate crystals, investigation of ligand field strength on Cu(II) complex spectra, synthesis of $[Co(NH_3)_4(CO_3)]NO_3$, determination of complex ion composition using Job's method, synthesis of potassium alum, degradation of dyes using photocatalysts, and determination of metal content in biological systems. |
| SMKM3029 | Instrumentation Analysis | This course introduces chemical instrumentation including electromagnetic waves, UV-VIS, IR, AAS, NMR, MS, GC, HPLC, Raman spectroscopy, potentiometry, and voltammetry. |
| SMKM3031 | Practicum of Instrumentation Analysis | This laboratory course introduces chemical instrumentation available in the Department of Chemistry laboratories. |
| SMKM3033 | Organic Chemistry III | This course discusses dipole moments in bonding, factors affecting molecular reactivity (electronic, inductive, and steric effects), LEFR, reaction control via kinetics and thermodynamics, reaction mechanisms, solvent effects (solvolysis), organic acid-base concepts, steric effects, homogeneous catalysis, mechanisms of E1, E2, SN1, SN2, and SNi reactions, oxidative elimination, isotope labeling, free radical reactions, photochemical reactions, and HOMO-LUMO concepts in photochemical reactions. |
| SMKM3035 | Structure Elucidation of Organic | This course covers structure determination of simple organic compounds based on spectral data from UV-Vis, IR, mass spectrometry, and 1H and 13C NMR. |
| SMKM3037 | Biochemistry III | This course explains how genetic codes are passed from one generation to the next and how they are translated into functional molecules through transcription and translation processes. |
| SMPA3013 | Entrepreneurship | This course is designed to develop students' soft skills in entrepreneurship, preferably in areas related to their field of study. The content is aimed at changing student perceptions and guiding them to prepare business plans and implement simple business activities. |
| SMPA3015 | Practicum of Entrepreneurship | This course trains students in practical entrepreneurship skills aligned with their academic field. It includes materials to shift students' perspectives about the business world, leading to the preparation of business plans and execution of simple business projects. |

| Code | Course Title | Course Description |
|---|---|---|
| SMKM3032 | Physical Chemistry IV | This is a compulsory course that covers solutions and colloidal systems, surface chemistry (capillarity), interfacial thermodynamics, surface films of solute components, adsorption-desorption, comparison of physical and chemical adsorption, wetting, flotation and detergents, scientific publications on surface chemistry. The course also covers classification of solids, identification methods such as XRD and thermal analysis, synthesis of pure solids, crystal structure, crystal defects, phase transitions, electronic structure, and the electrical, optical, magnetic, and chemical reactivity properties of solids. |
| SMKM3034 | Organometallics | This course explores the fundamental concepts of organometallic compounds, including the 18-electron rule, classification and bonding types, and general properties of organometallic species. It also discusses approaches to organometallic synthesis and design, reaction types and mechanisms, and the applications of organometallic compounds in biological, pharmaceutical, industrial, and environmental systems. |
| SMKM3036 | Organic Chemistry of Natural Product | This course explains the classification and structural categorization of secondary metabolites produced by natural resources, especially plants. The course introduces the biosynthesis of secondary metabolites, specific reactions for each metabolite group, and the physiological and bioactive properties of these compounds. |
| SMKM3038 | Biochemistry Research Techniques | This course introduces techniques for analyzing and characterizing biomolecules using various methods and instruments. |
| SMKM3040 | Research Methodology | This course provides an understanding of research methodology, proposal and final project writing formats, literature review techniques, scientific writing and publication guidelines, as well as data analysis. The course outcome is a draft of an Bachelor in Chemistry Program thesis proposal. |
| SMKM3042 | Colloquium | This course focuses on reviewing and presenting reputable, up-to-date international scientific journals. The content is translated and compiled into scientific papers, which are then presented in English in a seminar forum. |
| MKWUP001 | Community Service Program | This course prepares students to adapt, learn, socialize with the community, and contribute to solving community problems. |
| SMPAP001 | Internship | This course provides students with opportunities to gain fieldwork experience by applying the knowledge gained during their studies. Students are required to prepare a report and present it in a scientific forum. |

| Code | Course Title | Course Description |
|---|---|---|
| SMPAP002 | Research Proposal | This course involves the preparation of a research plan following the guidelines for final projects issued by the Faculty of Mathematics and Natural Sciences, Universitas Syiah Kuala. The proposal is then presented before peers and examiners. |
| SMPAPA01 | Final Project | This course integrates cognitive, affective, and psychomotor competencies through the implementation and writing of a research report based on the student's field of study. The thesis is presented in a peer seminar and a comprehensive examination before a board of examiners. |
| SMKM6039 | Electrochemistry | This course covers: introduction to electrochemistry, thermodynamic properties of ions in solution, electrode processes, electrochemical cells, corrosion, fundamental principles of corrosion control, metal coating techniques, and electroplating. |
| SMKM6041 | Material Chemistry | This course explores the definitions and characteristics of crystal materials, biomaterials, polymers, porous materials, composites, self-assembly, photonic and electronic materials, nanomaterials, as well as current trends in material design and engineering. |
| SMKM6043 | Surface Chemistry | This course introduces the fundamental concepts of surface chemistry and their applications in chemical industry technologies. Topics include surface chemical phenomena, applications in various technologies, surface analysis and characterization techniques, and relevant scientific publications. |
| SMKM6045 | Petroleum Chemistry | This course discusses the composition and properties of petroleum, biomarker analysis, petroleum type classification, petroleum composition, testing methods, evaluation, and management of petroleum products. |
| SMKM6047 | Radiation Chemistry | This elective course in physical chemistry covers radiation classification, interaction of radiation with matter, properties of charged particles, excitation and ionization phenomena, gas-phase radiation chemistry, solvated electrons, electron thermalization, and electron mobility in liquid hydrocarbons. |
| SMKM6049 | Bioinorganic Chemistry | This course examines the roles of inorganic elements in biological systems, including structure and bonding, electron transfer in biochemical reactions, the roles of minerals and vitamins in the human body, the functions and effects of metals in biological systems, and current research developments on metallobiomolecules. |
| SMKM6051 | Catalysts | This course introduces the fundamental concepts of catalysis, the classification of catalysts (heterogeneous, homogeneous, and photocatalysts), catalyst synthesis, characterization methods, activity testing, and applications in various fields. The course also discusses recent developments and innovations in catalytic chemistry and its applications. |

| Code | Course Title | Course Description |
|---|---|---|
| SMKM6053 | Mineralogy | This course discusses the fundamental principles of mineralogy, types and classification of minerals, ionic bonding and charge in minerals, crystal structure and chemical bonding in minerals, and crystallography. It also explores the physical and chemical properties of minerals, their utilization and applications, and mineral-based natural resources. |
| SMKM6055 | Applied Analytical Chemistry | This course discusses the scope of applied analytical chemistry, laboratory quality systems, method validation, analysis of salt mixtures, water analysis, fertilizer and pesticide residue analysis, organic waste analysis, fuel analysis, essential oil analysis, and food analysi. |
| SMKM6057 | Environmental Chemistry | This course discusses the sources, reactions, transport, impacts, and fate of chemical species in air, water, and soil, as well as the effects of human activities. It broadly covers atmospheric, hydrospheric, and lithospheric chemistry, sources of pollution, chemical processes leading to environmental pollution, and mitigation strategies. |
| SMKM6059 | Chemical Analysis of Halal Products | This course discusses the importance of halal-certified products, the halal certification process, critical control points in halal products, analysis of porcine and alcohol derivatives using rapid test techniques, analysis of porcine derivatives using HPLC, FTIR, and DSC, analysis of porcine derivatives using PCR, halal product analysis using immuno-based assays (ELISA) and metabolomics approach, alcohol analysis using various analytical methods, recent developments in halal product analysis methods, and their applications (based on current scientific articles). |
| SMKM6061 | Introduction of Chromatography | This course introduces the concepts of functional group interconversion and functionalization, principles of C–C bond formation (including organometallic reactions, carbocation/carbanion stability, and related nucleophilic reactions), principles of C–heteroatom bond formation, multiple bond formation, ring Closure and cyclization of open-chain carbon structures, and the formation of Diels–Alder products. |
| SMKM6063 | Introduction to Organic Synthesis | This course introduces the concepts of functional group interconversion and functionalization, principles of C–C bond formation (including organometallic reactions, carbocation/carbanion stability, and related nucleophilic reactions), principles of C–heteroatom bond formation, multiple bond formation, ring closure and cyclization of open-chain carbon structures, and the formation of Diels–Alder products. |
| SMKM6065 | Basic Bioassay Technology | This course explains bioassay techniques including both in vitro and in vivo methods; classification of bioassays into qualitative and quantitative types, covering biological, chemical, microbiological, and immunological assays. |

| Code | Course Title | Course Description |
|---|---|---|
| SMKM6067 | Bioinformatics | This course trains students to understand and utilize biomolecular databases using various analytical software tools.. |
| SMKM6069 | Food Chemistry | This course applies basic biochemical knowledge to address issues in food science, including food product substitution and the health impact of food additives. |
| SMKM6071 | Medicinal Chemistry | This course discusses metabolic disorders leading to diseases and the mechanisms of drug–receptor interactions as a basis for new drug development.. |
| SMKM6044 | Solid State Chemistry | This elective course in physical chemistry covers the classification of solid substances, identification techniques using XRD and thermal analysis, synthesis of pure solids, crystal structure, crystal defects, phase transitions, electronic structures, and the electrical, optical, and magnetic properties of solids, as well as chemical reactions in solids. |
| SMKM6046 | Industrial Chemistry | This course covers industrial management systems, industrial economics, mass and energy balances, process equipment, and unit operations in various chemical manufacturing industries. |
| SMKM6048 | Polymer Chemistry | This course covers the fundamental concepts of polymerization and their applications in polymer technology. Topics include polymer structures, addition and condensation polymerization, copolymerization, polymerization conditions, chemical transformation of polymers, polymer rheology, polymer additives, polymer characterization, and current developments in polymer applications. |
| SMKM6050 | Chemistry of Colloid | This course discusses the fundamentals of colloid chemistry with industrial applications. Topics include colloid classification, preparation, electrical, kinetic, optical, and flow properties, colloidal stability, electrokinetic phenomena, surfactants, sol-gel, wettability, detergency, emulsions, flotation, and colloid rheology. |
| SMKM6052 | Computational Chemistry | This course discusses theoretical chemical approaches and calculations, the use of computational software for chemical analysis, and applications in chemical modeling and calculation. |
| SMKM6054 | Coordination Chemistry | This course covers the chemical bonding in coordination compounds, geometric structures, synthesis and characterization of coordination complexes, stability and reaction mechanisms, as well as current advances and applications in coordination chemistry. |

| Code | Course Title | Course Description |
|---|---|---|
| SMKM6056 | Capita Selecta in Inorganic Chemistry | This course reviews the latest developments and trends in inorganic chemistry, based on primary literature sources such as recent journals, scientific magazines, and scholarly articles in the field. |
| SMKM6058 | Inorganic Synthesis | This course discusses the basic principles of inorganic synthesis, various methods for the synthesis and characterization of simple inorganic and coordination compounds, purification techniques, and their applications. It also explores recent research developments on the synthesis and application of both simple and complex inorganic compounds. |
| SMKM6060 | Sensors and Biosensors | This course explores the use of chemical sensors and biosensors for sample analysis, including environmental, pharmaceutical, clinical, food, and cosmetic samples. Measurement techniques are based on electrical and optical principles. |
| SMKM6062 | Chemometrics | This course covers the application of mathematics, statistics, and computation in chemical studies, including error analysis, statistical evaluation of repeated measurements, uncertainty measurements, significance testing, calibration methods, validation, sampling, experimental design, and multivariate analysis. |
| SMKM6064 | Advanced Separation Techniques | This course includes topics such as membrane filtration, solid-phase microextraction (SPE), liquid-liquid extraction (LLE), microwave-assisted extraction, ion exchange chromatography, affinity chromatography, gel permeation chromatography, adsorption chromatography, and size exclusion chromatography. |
| SMKM6066 | Environmental Impact Assessment | This course broadly discusses national environmental policies, the concept and benefits of EIA, screening, scoping, impact prediction, risk analysis, impact evaluation, environmental management and monitoring, community participation, and techniques for preparing and evaluating EIA documents. |
| SMKM6068 | Waste Treatment | This course discusses the application of chemistry in daily life, local and Global needs, adaptation and participation in professional, industrial, and community activities, as well as data collection, processing, analysis, and interpretation of chemical measurements and separation techniques. |
| SMKM6070 | Organic Stereo Chemistry | This course covers concepts in stereochemistry, geometrical isomerization, stereochemistry of olefins, elimination and substitution reactions, fused and bridged ring systems, and the stereochemistry of alkyl halides. |
| SMKM6072 | Secondary Metabolite Analysis | This course identifies sources of secondary metabolites, sampling and handling of plant materials, phytochemical identification techniques, analysis methods (extraction, isolation, elucidation), and review of related articles on |

| Code | Course Title | Course Description |
|---|---|---|
| | | natural product compounds. |
| SMKM6074 | Microbiology | This course discusses the use of microorganisms in food development, drug discovery, bioremediation, and energy. |
| SMKM6076 | Fermentation Technology | This course discusses the application of fermentation techniques in the production of primary and secondary metabolites in food, energy, and healthcare sectors. |
| SMKM6078 | Biotechnology | This course discusses the application of biotechnology to address food, energy, and health issues. |
| SMKM6080 | Practicum of Environmental Impact Assessment | This elective course helps students understand environmentally conscious development through practical understanding of environmental impact assessment concepts and objectives. The course includes case studies, field practice, simulations of document preparation and assessment, and site visits to observe real environmental impact assessment implementation. |
| SMPA6001 | Entrepreneurial Practice | This course encourages students to develop entrepreneurial ventures through guided stages including proposal presentation, implementation, participation in training, and final reporting and presentation. |
| SMPA6002 | Scientific Publication | This course serves as an alternative to the Bachelor in Chemistry Program thesis defense. Students are required to publish their final project in a scientific outlet. |
| SMPA6003 | Industrial Internship A | This internship involves education, training, and learning activities at USK partner institutions relevant to students' competencies, based on the KKNI and SN-Dikti standards. Internships can be conducted in government or private institutions, industries, NGOs, multilateral organizations, or startups. |
| SMPA6004 | Industrial Internship B | |
| SMPA6005 | Village Project A | A community service program where students contribute to rural or remote area development in terms of local economy, infrastructure, and more. It aims to equip students with real-world experience in identifying potential and solving problems in rural communities. |
| SMPA6006 | Village Project B | |
| SMPA6007 | Science Teaching Practice A | This program involves students teaching science subjects at elementary, junior, or senior high schools, particularly in underdeveloped, outermost, and frontier regions (3T), aligned with the student's academic field. |
| SMPA6008 | Science Teaching Practice B | |

### 3.6 Course Distribution in the Bachelor in Chemistry Program(SMKM)

Table 3.9 provides a list of the compulsory and elective courses offered in the Bachelor in Chemistry Program.

Table 3.9 List of compulsory courses

| SEMESTER 1 | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | MKWU1002 | Civic Education | 2 | 2-0 | C | - |
| 2 | MKWU1005 | Disaster Management And Environment | 2 | 2-0 | C | - |
| 3 | MKWU1006 | Character Building 1 | 0 | 0-0 | C | - |
| 4 | SMPA1001 | Introduction to Calculus | 3 | 3-0 | C | - |
| 5 | SMPA1003 | Introduction to Physics | 2 | 2-0 | C | - |
| 6 | SMPA1005 | Introduction to Chemistry | 2 | 2-0 | C | - |
| 7 | SMPA1007 | Introduction to Biology | 2 | 2-0 | C | - |
| 8 | SMPA1009 | Introduction to Industrial Revolution | 2 | 2-0 | C | - |
| 9 | SMKM1003 | Principle of Separation Methods | 2 | 2-0 | C | |
| 10 | SMPA1021 | Practicum of Introduction to Physics | 1 | 0-1 | C | - |
| 11 | SMPA1019 | Practicum of Introduction to Chemistry | 1 | 0-1 | C | - |
| 12 | SMPA1017 | Practicum of Introduction to Biology | 1 | 0-1 | C | - |
| Total | | | 20 | 17-3 | | |

| SEMESTER 2 | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | MKWU1001 | Pancasila | 2 | 2-0 | C | - |
| 2 | MKWU1003 | Indonesian Language | 2 | 2-0 | C | - |
| 3 | MKWU1004 | English | 2 | 2-0 | C | - |
| 4 | MKWU1007 | Character Building 2 | 0 | 0-0 | C | MKWU1006 |
| 5 | SMPA1011 | Statistical Methods | 2 | 2-0 | C | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | SMKM1002 | Basic Chemistry | 3 | 3-0 | C | - |
| 7 | SMKM1004 | Practicum of Basic Chemistry | 1 | 0-1 | C | - |
| 8 | SMKM1006 | Scientific Mathematics | 2 | 2-0 | C | - |
| 9 | SMKM1008 | Fundamental of Physics | 3 | 3-0 | C | - |
| 10 | SMKM1010 | Laboratory Management | 2 | 2-0 | C | - |
| Total | | | 19 | 18-1 | | |

| **SEMESTER 3** | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | MKWU2001 | Religion Education | 2 | 2-0 | C | MKWU1007 |
| 2 | SMKM2005 | Physical Chemistry I | 3 | 3-0 | C | SMKM1002 |
| 3 | SMKM2007 | Practicum of Physical Chemistry I | 1 | 0-1 | C | SMKM1002 |
| 4 | SMKM2009 | Inorganic Chemistry I | 3 | 3-0 | C | SMPA1005 |
| 5 | SMKM2011 | Analytical Chemistry I | 3 | 3-0 | C | SMKM1002 |
| 6 | SMKM2013 | Practicum of Analytical Chemistry I | 1 | 0-1 | C | SMKM1002 |
| 7 | SMKM2015 | Organic Chemistry I | 3 | 3-0 | C | SMKM1002 |
| 8 | SMKM2017 | Practicum of Organic Chemistry I | 1 | 0-1 | C | SMKM1002 |
| 9 | SMKM2019 | Biochemistry I | 3 | 3-0 | C | SMKM1002 |
| 10 | SMKM2021 | Practicum of Biochemistry I | 1 | 0-1 | C | SMKM1004 |
| Total | | | 21 | 17-4 | | |

| **SEMESTER 4** | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | SMKM2012 | Physical Chemistry II | 3 | 3-0 | C | SMKM1002 |
| 2 | SMKM2014 | Practicum of Physical Chemistry II | 1 | 0-1 | C | SMKM1004 |
| 3 | SMKM2016 | Inorganic Chemistry II | 3 | 3-0 | C | SMKM1002 |
| 4 | SMKM2018 | Practicum of Inorganic | 1 | 0-1 | C | SMKM1004 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Chemistry II | | | | |
| 5 | SMKM2020 | Analytical Chemistry II | 3 | 3-0 | C | SMKM1002 |
| 6 | SMKM2022 | Practicum of Analytical Chemistry II | 1 | 0-1 | C | SMKM1004 |
| 7 | SMKM2024 | Organic Chemistry II | 3 | 3-0 | C | SMKM1002 |
| 8 | SMKM2026 | Practicum of Organic Chemistry II | 1 | 0-1 | C | SMKM1004 |
| 9 | SMKM2028 | Biochemistry II | 3 | 3-0 | C | SMKM1002 |
| 10 | SMKM2030 | Practicum of Biochemistry II | 1 | 0-1 | C | SMKM1004 |
| Total | | | 20 | 15-5 | | |

| **SEMESTER 5** | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | SMKM3023 | Physical Chemistry III | 3 | 3-0 | C | SMKM2005 |
| 2 | SMKM3025 | Inorganic Chemistry III | 3 | 3-0 | C | SMKM2009 |
| 3 | SMKM3027 | Practicum of Inorganic Chemistry III | 1 | 0-1 | C | SMKM2018 |
| 4 | SMKM3029 | Instrumentation Analysis | 3 | 3-0 | C | SMKM2020 |
| 5 | SMKM3031 | Practicum of Instrumentation Analysis | 1 | 0-1 | C | SMKM2020 |
| 6 | SMKM3033 | Organic Chemistry III | 3 | 3-0 | C | SMKM2015 |
| 7 | SMKM3035 | Structure Elucidation of Organic | 3 | 3-0 | C | SMKM2015 |
| 8 | SMKM3037 | Biochemistry III | 2 | 2-0 | C | SMKM2019 |
| 9 | SMPA3013 | Entrepreneurship | 2 | 2-0 | C | - |
| 10 | SMPA3015 | Practicum of Entrepreneurship | 1 | 0-1 | C | - |
| Total | | | 22 | 19-3 | | |

| SEMESTER 6 | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | SMKM3032 | Physical Chemistry IV | 3 | 3-0 | C | SMKM2012 |
| 2 | SMKM3034 | Organometallics | 2 | 2-0 | C | SMKM2016 |
| 3 | SMKM3036 | Organic Chemistry of Natural Product | 2 | 2-0 | C | SMKM2015 |
| 4 | SMKM3038 | Biochemistry Research Techniques | 2 | 2-0 | C | SMKM2019 |
| 5 | SMKM3040 | Research Methodology | 2 | 2-0 | C | SMPA1011 |
| 6 | SMKM3042 | Colloquium | 2 | 0-2 | C | MKWU1004 dan * |
| 7 | | Elective courses | 8 | | E | |
| Total | | | 21 | 21-2 | | |

| SEMESTER 7 | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | MKWUP001 | Community Service Program | 2 | 0-2 | C | ** |
| 2 | SMPAP001 | Internship | 3 | 0-3 | C | *** |
| 3 | SMPAP002 | Research Proposal | 2 | 0-2 | C | SMKM3040 dan **** |
| 4 | | Elective courses | 10 | | E | |
| Total | | | 17 | 10-7 | | |

| SEMESTER 8 | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | SMPAPA01 | Final Project | 4 | 0-4 | C | ***** |
| Total | | | 4 | 0-4 | | |

**Note:**
T= Theory, refers to classroom-based instructional hours
P= Practicum, refers to hands-on or laboratory-based instructional hours
C = Compulsory
E = Elective
* Completed a minimum of 83 credits (SKS)

** Community Service Program prerequisites must comply with the regulations set by the USK Community Service Board (Bapel KKN USK)
*** Refer to the Internship guidelines (minimum of 100 credits completed)
**** Refer to the final project guidelines (minimum of 120 credits completed)
***** Refer to the final project guidelines (must have passed the Proposal course or be enrolled concurrently)

Students who enroll in a course with a practical/laboratory component must also enroll in the corresponding practical/lab course in the same semester or have already passed the theoretical course. For example, a student enrolling in Analytical Chemistry I must also enroll in Practical Analytical Chemistry I or have already passed Analytical Chemistry I.

| **ELECTIVE COURSES OFFERED IN SEMESTER 7** | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | SMKM6039 | Electrochemistry | 2 | 2-0 | E | SMKM2012 |
| 2 | SMKM6041 | Material Chemistry | 2 | 2-0 | E | SMKM2005 |
| 3 | SMKM6043 | Surface Chemistry | 2 | 2-0 | E | SMKM2005 |
| 4 | SMKM6045 | Petroleum Chemistry | 2 | 2-0 | E | SMKM2005 |
| 5 | SMKM6047 | Radiation Chemistry | 2 | 2-0 | E | SMKM2005 |
| 6 | SMKM6049 | Bioinorganic Chemistry | 2 | 2-0 | E | SMKM2009 |
| 7 | SMKM6051 | Catalysts | 2 | 2-0 | E | SMKM2009 |
| 8 | SMKM6053 | Mineralogy | 2 | 2-0 | E | SMKM2009 |
| 9 | SMKM6055 | Applied Analytical Chemistry | 2 | 2-0 | E | SMKM2020 |
| 10 | SMKM6057 | Environmental Chemistry | 2 | 2-0 | E | SMKM2013 |
| 11 | SMKM6059 | Chemical Analysis of Halal Products | 2 | 2-0 | E | SMKM2013 |
| 12 | SMKM6061 | Introduction of Chromatography | 2 | 2-0 | E | SMKM2020 |
| 13 | SMKM6063 | Introduction to Organic Synthesis | 2 | 2-0 | E | SMKM2015 |
| 14 | SMKM6065 | Basic Bioassay Technology | 2 | 2-0 | E | SMKM2015 |
| 15 | SMKM6067 | Bioinformatics | 2 | 2-0 | E | SMKM2019 |
| 16 | SMKM6069 | Food Chemistry | 2 | 2-0 | E | SMKM2028 |
| 17 | SMKM6071 | Medicinal Chemistry | 2 | 2-0 | E | SMKM2019 |
| 18 | SMPA6002 | Scientific Publication | 11 | 0-11 | E | - |
| 19 | SMPA6004 | Industrial Internship B | 11 | 0-11 | E | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 20 | SMPA6006 | Village Project B | 12 | 0-12 | E | - |
| 21 | SMPA6008 | Science Teaching Practice B | 12 | 0-12 | E | - |
| Total | | | 80 | 34-46 | | |

| ELECTIVE COURSES OFFERED IN SEMESTER 6 | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **(T-P)** | **Category** | **Prerequisite** |
| 1 | SMKM6044 | Solid State Chemistry | 2 | 2-0 | E | SMKM2012 |
| 2 | SMKM6046 | Industrial Chemistry | 2 | 2-0 | E | SMKM2005 |
| 3 | SMKM6048 | Polymer Chemistry | 2 | 2-0 | E | SMKM2005 |
| 4 | SMKM6050 | Chemistry of Colloid | 2 | 2-0 | E | SMKM2005 |
| 5 | SMKM6052 | Computational Chemistry | 2 | 2-0 | E | SMKM3023 |
| 6 | SMKM6054 | Coordination Chemistry | 2 | 2-0 | E | SMKM2016 |
| 7 | SMKM6056 | Capita Selecta in Inorganic Chemistry | 2 | 2-0 | E | SMKM2016 |
| 8 | SMKM6058 | Inorganic Synthesis | 2 | 2-0 | E | SMKM2016 |
| 9 | SMKM6060 | Sensors and Biosensors | 2 | 2-0 | E | SMKM2011 |
| 10 | SMKM6062 | Chemometrics | 2 | 2-0 | E | SMKM2011 |
| 11 | SMKM6064 | Advanced Separation Techniques | 2 | 2-0 | E | SMKM2011 |
| 12 | SMKM6066 | Environmental Impact Assessment | 2 | 2-0 | E | SMKM2011 |
| 13 | SMKM6068 | Waste Treatment | 2 | 2-0 | E | SMKM2011 |
| 14 | SMKM6070 | Organic Stereo Chemistry | 2 | 2-0 | E | SMKM2015 |
| 15 | SMKM6072 | Secondary Metabolite Analysis | 2 | 2-0 | E | SMKM2015 |
| 16 | SMKM6074 | Microbiology | 2 | 2-0 | E | SMKM2019 |
| 17 | SMKM6076 | Fermentation Technology | 2 | 2-0 | E | SMKM2019 |
| 18 | SMKM6078 | Biotechnology | 2 | 2-0 | E | SMKM3037 |
| 19 | SMKM6080 | Practicum of Environmental Impact Assessment | 1 | 0-1 | E | SMKM2011 |
| 20 | SMPA6001 | Entrepreneurial Practice | 17 | 0-17 | E | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| 21 | SMPA6003 | Industrial Internship A | 17 | 0-17 | E | - |
| 22 | SMPA6005 | Village Project A | 18 | 0-18 | E | - |
| 23 | SMPA6007 | Science Teaching Practice A | 16 | 0-16 | E | - |
| Total | | | 104 | 36-69 | | |

In addition to general university-wide courses, the Faculty of Mathematics and Natural Sciences (FMIPA) offers elective courses to support the *Merdeka Belajar Kampus Merdeka* (MBKM) program. These elective courses may be converted into academic credit for MBKM activities undertaken by students for one full semester (equivalent to 20 credits) or less than one semester (minimum 10 credits). The list of MBKM elective courses is available in Appendix 5.

### 3.7 Curriculum Summary

Table 3.10 provides information on the number of credits distributed across different categories of courses.

Table 3.10. General information on course content

| Description | Credits (SKS) |
|---|---|
| Minimum total credits required for graduation | 144 |
| Minimum elective credits to be completed | 18 |
| Total number of elective courses offered | 71 |
| Total number of MBKM elective courses offered | 114 |
| Total number of university general (MKWU) courses | 12 |
| Total number of faculty-level courses | 25 |
| Total components of skill-based courses | 30 |
| Total components of foundational scientific courses | 164 |
| Total components of discipline-specific/expertise courses | 25 |
| Total curricular/extracurricular activities promoting innovation, entrepreneurship, and digital competencies | 15 |
| Number of course components aligned with SDGs vision | 107 |

Table 3.11. Characteristics of elective courses

| No | Course Code | Course Title | Credits (SKS) | Characteristics (√) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | E | F | G | T | P |
| 1. | SMKM6039 | Electrochemistry | 2 | √ | √ | | √ | √ | | | | |
| 2. | SMKM6041 | Material Chemistry | 2 | √ | √ | | √ | √ | | | | |
| 3. | SMKM6043 | Surface Chemistry | 2 | √ | √ | | √ | √ | | | | |
| 4. | SMKM6045 | Petroleum Chemistry | 2 | √ | √ | | | √ | | | | |
| 5. | SMKM6047 | Radiation Chemistry | 2 | √ | √ | | | √ | | | | |
| 6. | SMKM6049 | Bioinorganic Chemistry | 2 | √ | √ | | | √ | | | | |
| 7. | SMKM6051 | Catalysts | 2 | √ | √ | | | √ | | | | |
| 8. | SMKM6053 | Mineralogy | 2 | √ | √ | | | √ | | | | |
| 9. | SMKM6055 | Applied Analytical Chemistry | 2 | √ | √ | | | √ | | | | |

| No | Course Code | Course Title | Credits (SKS) | Characteristics (√) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | E | F | G | T | P |
| 10. | SMKM6057 | Environmental Chemistry | 2 | √ | √ | | | √ | | | | |
| 11. | SMKM6059 | Chemical Analysis of Halal Products | 2 | √ | √ | | √ | √ | | | | |
| 12. | SMKM6061 | Introduction of Chromatography | 2 | √ | √ | | | √ | | | | |
| 13. | SMKM6063 | Introduction to Organic Synthesis | 2 | √ | | √ | | | | | | |
| 14. | SMKM6065 | Basic Bioassay Technology | 2 | | √ | | | | | | | |
| 15. | SMKM6067 | Bioinformatics | 2 | √ | | √ | | | | | √ | |
| 16. | SMKM6069 | Food Chemistry | 2 | √ | √ | | √ | √ | | | | |
| 17. | SMKM6071 | Medicinal Chemistry | 2 | √ | | √ | | √ | | | | |
| 18. | SMKM6044 | Solid State Chemistry | 2 | √ | √ | | | √ | | | | |
| 19. | SMKM6046 | Industrial Chemistry | 2 | √ | √ | | √ | √ | | | | |
| 20. | SMKM6048 | Polymer Chemistry | 2 | √ | √ | | √ | √ | | | | |
| 21. | SMKM6050 | Chemistry of Colloid | 2 | √ | √ | | √ | √ | | | | |
| 22. | SMKM6052 | Computational Chemistry | 2 | √ | √ | √ | | √ | | | | |
| 23. | SMKM6054 | Coordination Chemistry | 2 | √ | √ | | | √ | | | | |
| 24. | SMKM6056 | Capita Selecta in Inorganic Chemistry | 2 | √ | √ | | | √ | | | | |
| 25. | SMKM6058 | Inorganic Synthesis | 2 | √ | √ | | | √ | | | | |
| 26. | SMKM6060 | Sensors and Biosensors | 2 | √ | √ | | √ | √ | | | | |
| 27. | SMKM6062 | Chemometrics | 2 | √ | √ | √ | √ | √ | | | | |
| 28. | SMKM6064 | Advanced Separation Techniques | 2 | √ | √ | | | √ | | | | |
| 29. | SMKM6066 | Environmental Impact Assessment | 2 | √ | √ | | √ | √ | | | | |
| 30. | SMKM6068 | Waste Treatment | 2 | √ | √ | | | √ | | | | |
| 31. | SMKM6070 | Organic Stereo Chemistry | 2 | √ | | | | | | | | |
| 32. | SMKM6072 | Secondary Metabolite Analysis | 2 | √ | √ | | | | | | | |
| 33. | SMKM6074 | Microbiology | 2 | √ | √ | | √ | √ | | | | |
| 34. | SMKM6076 | Fermentation Technology | 2 | √ | √ | | √ | √ | | | | |
| 35. | SMKM6078 | Biotechnology | 2 | √ | | √ | | √ | | | | |
| 36. | SMKM6080 | Practicum of Environmental Impact Assessment | 1 | √ | √ | | | | √ | | | √ |

| No | Course Code | Course Title | Credits (SKS) | Characteristics (√) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | B | C | D | E | F | G | T | P |
| 37. | SMPA6001 | Entrepreneurial Practice | 17 | | √ | | √ | | √ | | | √ |
| 38. | SMPA6002 | Scientific Publication | 11 | √ | | √ | | | √ | | | |
| 39. | SMPA6003 | Industrial Internship A | 17 | | √ | | | √ | √ | | | √ |
| 40. | SMPA6004 | Industrial Internship B | 11 | | √ | | | √ | √ | | | √ |
| 41. | SMPA6005 | Village Project A | 18 | | √ | | | | √ | | | √ |
| 42. | SMPA6006 | Village Project B | 12 | | √ | | | | √ | | | √ |
| 43.. | SMPA6007 | Science Teaching Practice A | 16 | | √ | | | | √ | | | √ |
| 44. | SMPA6008 | Science Teaching Practice B | 12 | | √ | | | | √ | | | √ |

A = Deepening disciplinary knowledge,
B = Enhancing skills/professionalism in the workforce,
C = Improving IT skills,
D = Encouraging entrepreneurship,
E = Developing soft skills,
F = Eligible for conversion to MBKM activities
G = Others
T = Tutorial
P = Practical

Table 3.12. List of courses related to the implementation of SDGs, Research-Based Learning (PBR), Project-Based Learning (PjBL), Case Method (Case-M), and/or the Independent Learning Program (MBKM)

| No | Course Code | Course Title | Credits (SKS) | Category | SDG Alignment | Learning Characteristics | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PBR | PjBL | Case-M | MBKM |
| 1 | MKWU1002 | Civic Education | 2 | C | - | | | | |
| 2 | MKWU1005 | Disaster Management and Environment | 2 | C | - | | | | |
| 3 | MKWU1006 | Character Building I | 0 | C | - | | | | |
| 4 | SMPA1001 | Introduction to Calculus | 3 | C | - | | | | |
| 5 | SMPA1003 | Introduction to Physics | 2 | C | - | | | | |
| 6 | SPHY1001 | Practicum of Introduction to Physics | 1 | C | - | | | | |
| 7 | SMPA1005 | Introduction to Chemistry | 2 | C | - | | | | |

| No | Course Code | Course Title | Credits (SKS) | Category | SDG Alignment | Learning Characteristics | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PBR | PjBL | Case-M | MBKM |
| 8 | SMKM1001 | Practicum of Introduction to Chemistry | 1 | C | - | | | | |
| 9 | SMPA1007 | Introduction to Biology | 2 | C | - | | | | |
| 10 | SMBI1001 | Practicum of Introduction to Biology | 1 | C | - | | | | |
| 11 | SMPA1011 | Statistical Methods | 2 | C | - | | | | |
| 12 | MKWU1001 | Pancasila | 2 | C | - | | | | |
| 13 | MKWU1003 | Indonesian Language | 2 | C | - | | | | |
| 14 | MKWU1004 | English | 2 | C | - | | | | |
| 15 | MKWU1007 | Character Building 2 | 0 | C | - | | | | |
| 16 | SMPA1009 | Introduction to Industrial Revolution | 2 | C | - | | | | |
| 17 | SMKM1002 | Basic Chemistry | 3 | C | - | | | | |
| 18 | SMKM1004 | Practicum of Basic Chemistry | 1 | C | - | | | | |
| 19 | SMKM1006 | Scientific Mathematics | 2 | C | - | | | | |
| 20 | SMKM1008 | Fundamental of Physics | 3 | C | - | | | | |
| 21 | SMKM1010 | Laboratory Management | 2 | C | - | | | √ | |
| 22 | SMKM1003 | Principle of Separation Methods | 2 | C | 4,6,8,9 | | | √ | |
| 23 | SMKM2005 | Physical Chemistry I | 3 | C | - | | | | |
| 24 | SMKM2007 | Practicum of Physical Chemistry I | 1 | C | - | | | | |
| 25 | SMKM2009 | Inorganic Chemistry I | 3 | C | 4 | | | | |
| 26 | SMKM2011 | Analytical Chemistry I | 3 | C | 1,3,4,7 | | | | |
| 27 | SMKM2013 | Practicum of Analytical Chemistry I | 1 | C | 1,3,4,9 | √ | | | |
| 28 | SMKM2015 | Organic Chemistry I | 3 | C | - | | | | |
| 29 | SMKM2017 | Practicum of Organic Chemistry I | 1 | C | - | | | | |
| 30 | SMKM2019 | Biochemistry I | 3 | C | - | | | | |
| 31 | SMKM2021 | Practicum of Biochemistry I | 1 | C | - | | | | |
| 32 | MKWU2001 | Religion Education | 2 | C | - | | | | |

| No | Course Code | Course Title | Credits (SKS) | Category | SDG Alignment | Learning Characteristics | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PBR | PjBL | Case-M | MBKM |
| 33 | SMKM2012 | Physical Chemistry II | 3 | C | - | | | | |
| 34 | SMKM2014 | Practicum of Physical Chemistry II | 1 | C | - | | | | |
| 35 | SMKM2016 | Inorganic Chemistry II | 3 | C | 4 | | | | |
| 36 | SMKM2018 | Practicum of Inorganic Chemistry II | 1 | C | 4 | | | | |
| 37 | SMKM2020 | Analytical Chemistry II | 3 | C | 6,7,9,13 | | | | |
| 38 | SMKM2022 | Practicum of Analytical Chemistry II | 1 | C | 6,7,9,13 | | | | |
| 39 | SMKM2024 | Organic Chemistry II | 3 | C | - | | | | |
| 40 | SMKM2026 | Practicum of Organic Chemistry II | 1 | C | - | | | | |
| 41 | SMKM2028 | Biochemistry II | 3 | C | - | | | | |
| 42 | SMKM2030 | Practicum of Biochemistry II | 1 | C | - | | | | |
| 43 | SMKM3023 | Physical Chemistry III | 3 | C | - | | | | |
| 44 | SMKM3025 | Inorganic Chemistry III | 3 | C | 3, 4 | | | | |
| 45 | SMKM3027 | Practicum of Inorganic Chemistry III | 1 | C | 3, 4 | | | | |
| 46 | SMKM3029 | Instrumentation Analysis | 3 | C | 3,4,6,9 | | | | |
| 47 | SMKM3031 | Practicum of Instrumentation Analysis | 1 | C | 3,4,6,9 | √ | | | |
| 48 | SMKM3033 | Organic Chemistry III | 3 | C | - | | | | |
| 49 | SMKM3035 | Structure Elucidation of Organic | 3 | C | - | | | √ | |
| 50 | SMKM3037 | Biochemistry III | 2 | C | 3 | | | | |
| 51 | SMPA3013 | Entrepreneurship | 2 | C | 4 | | | √ | √ |
| 52 | SMPA3015 | Practicum of Entrepreneurship | 1 | C | 4 | | √ | | √ |
| 53 | SMKM3032 | Physical Chemistry IV | 3 | C | - | | | | √ |
| 54 | SMKM3034 | Organometallics | 2 | C | 3, 4, 9 | | | | √ |
| 55 | SMKM3036 | Organic Chemistry of Natural Product | 2 | C | 13 | | | √ | √ |
| 56 | SMKM3038 | Biochemistry Research Techniques | 2 | C | 9 | | | | √ |

| No | Course Code | Course Title | Credits (SKS) | Category | SDG Alignment | Learning Characteristics | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PBR | PjBL | Case-M | MBKM |
| 57 | SMKM3040 | Research Methodology | 2 | C | 4 | | | | √ |
| 58 | SMKM3042 | Colloquium | 2 | C | - | | | √ | √ |
| 59 | MKWUP001 | Community Service Program | 2 | C | - | | √ | | √ |
| 60 | SMPAP001 | Internship | 3 | C | 9 | | | √ | √ |
| 61 | SMPAP002 | Research Proposal | 2 | C | - | | √ | | √ |
| 62 | SMPAPA01 | Final Project | 4 | C | - | | √ | | √ |
| 63 | SMKM6039 | Electrochemistry | 2 | E | 9 | | | √ | √ |
| 64 | SMKM6041 | Material Chemistry | 2 | E | 9 | | | √ | √ |
| 65 | SMKM6043 | Surface Chemistry | 2 | E | 9 | | | √ | √ |
| 66 | SMKM6045 | Petroleum Chemistry | 2 | E | 9 | | | √ | √ |
| 67 | SMKM6047 | Radiation Chemistry | 2 | E | - | | | √ | √ |
| 68 | SMKM6049 | Bioinorganic Chemistry | 2 | E | 3, 9, 12 | | | | √ |
| 69 | SMKM6051 | Catalysts | 2 | E | 3, 6, 7, 9 | | | | √ |
| 70 | SMKM6053 | Mineralogy | 2 | E | 9, 12, 15 | | | √ | √ |
| 71 | SMKM6055 | Applied Analytical Chemistry | 2 | E | 9,13 | | | √ | √ |
| 72 | SMKM6057 | Environmental Chemistry | 2 | E | 9,11,13,14,15 | | | √ | √ |
| 73 | SMKM6059 | Chemical Analysis of Halal Products | 2 | E | 2,3,4,9 | | | √ | √ |
| 74 | SMKM6061 | Introduction of Chromatography | 2 | E | 9,12,13 | | | √ | √ |
| 75 | SMKM6063 | Introduction to Organic Synthesis | 2 | E | - | | | | √ |
| 76 | SMKM6065 | Basic Bioassay Technology | 2 | E | - | | √ | | √ |
| 77 | SMKM6067 | Bioinformatics | 2 | E | 9 | | | √ | √ |
| 78 | SMKM6069 | Food Chemistry | 2 | E | 12 | | | √ | √ |
| 79 | SMKM6071 | Medicinal Chemistry | 2 | E | 3 | | | √ | √ |
| 80 | SMKM6044 | Solid State Chemistry | 2 | E | - | | | √ | √ |
| 81 | SMKM6046 | Industrial Chemistry | 2 | E | 9 | | | √ | √ |
| 82 | SMKM6048 | Polymer Chemistry | 2 | E | 9 | | | √ | √ |
| 83 | SMKM6050 | Chemistry of Colloid | 2 | E | 9 | | | √ | √ |
| 84 | SMKM6052 | Computational Chemistry | 2 | E | - | | √ | | √ |
| 85 | SMKM6054 | Coordination Chemistry | 2 | E | 3, 4, 9 | | | | √ |

| No | Course Code | Course Title | Credits (SKS) | Category | SDG Alignment | Learning Characteristics | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | PBR | PjBL | Case-M | MBKM |
| 86 | SMKM6056 | Capita Selecta in Inorganic Chemistry | 2 | E | 3, 4, 7, 9 | | | | √ |
| 87 | SMKM6058 | Inorganic Synthesis | 2 | E | 3, 4, 9, 12 | | | | √ |
| 88 | SMKM6060 | Sensors and Biosensors | 2 | E | 4,9,13 | | | √ | √ |
| 89 | SMKM6062 | Chemometrics | 2 | E | 9,12,13 | | √ | | √ |
| 90 | SMKM6064 | Advanced Separation Techniques | 2 | E | 9 | | | √ | √ |
| 91 | SMKM6066 | Environmental Impact Assessment | 2 | E | 9,13,14,15 | | | √ | √ |
| 92 | SMKM6068 | Waste Treatment | 2 | E | 9,13,14,15 | | | √ | √ |
| 93 | SMKM6070 | Organic Stereo Chemistry | 2 | E | - | | | | √ |
| 94 | SMKM6072 | Secondary Metabolite Analysis | 2 | E | - | | √ | | √ |
| 95 | SMKM6074 | Microbiology | 2 | E | 14,15 | | | √ | √ |
| 96 | SMKM6076 | Fermentation Technology | 2 | E | 9 | | √ | | √ |
| 97 | SMKM6078 | Biotechnology | 2 | E | 9 | | | √ | √ |
| 98 | SMKM6080 | Practicum of Environmental Impact Assessment | 1 | E | 6 | | | √ | √ |
| 99 | SMPA6001 | Entrepreneurial Practice | 17 | E | | | | | √ |
| 100 | SMPA6002 | Scientific Publication | 11 | E | | | | | √ |
| 101 | SMPA6003 | Industrial Internship A | 17 | E | | | | | √ |
| 102 | SMPA6004 | Industrial Internship B | 11 | E | | | | | √ |
| 103 | SMPA6005 | Village Project A | 18 | E | | | | | √ |
| 104 | SMPA6006 | Village Project B | 12 | E | | | | | √ |
| 105 | SMPA6007 | Science Teaching Practice A | 16 | E | | | | | √ |
| 106 | SMPA6008 | Science Teaching Practice B | 12 | E | | | | | √ |

*The Sustainable Development Goals (SDGs) represent a universal agenda agreed upon for achievement by 2030, aimed at promoting sustainable development grounded in human rights and equality. There are 17 goals and 169 specific targets, including: no poverty; zero hunger; good health and well-being; quality education; gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry, innovation and infrastructure; reduced inequalities; sustainable cities and*

*communities; responsible consumption and production; climate action; life below water; life on land; peace, justice and strong institutions; and partnerships for the goals (Bappenas, 2017).*
*SDGs = 20%*
*PBR = Research-Based Learning*
*PjBL = Project-Based Learning and/or Case-M = Case Method (>=50%)*
*MBKM = Merdeka Belajar – Kampus Merdeka*

## 3.8 Equivalence and Recognition of MBKM Activities for Credit Transfer (SKS)

### 3.8.1 Course Equivalence List

| Previous Courses | | | | Revised Courses | | | |
|---|---|---|---|---|---|---|---|
| **No** | **Course Code** | **Course Title** | **Credits (SKS)** | **No** | **Course Code** | **Course Title** | **Credits (SKS)** |
| 1 | MKS103 | Civic Education | 2 | 1 | MKWU1002 | Civic Education | 2 |
| 2 | MKS106 | Disaster Management and Environment | 2 | 2 | MKWU1005 | Disaster Management and Environment | 2 |
| 3 | MKS105 | Religion Education | 2 | 3 | MKWU1006 | Character Building I | 0 |
| 4 | MPA101 | Introduction to Calculus | 3 | 4 | SMPA1001 | Introduction to Calculus | 3 |
| 5 | MPA103 | Introduction to Physics | 3 | 5 | SMPA1003 | Introduction to Physics | 2 |
| 6 | MPA103 | Introduction to Physics | 3 | 6 | SPHY1001 | Practicum of Introduction to Physics | 1 |
| 7 | MPA105 | Introduction to Chemistry | 3 | 7 | SMPA1005 | Introduction to Chemistry | 2 |
| 8 | MPA105 | Introduction to Chemistry | 3 | 8 | SMKM1001 | Practicum of Introduction to Chemistry | 1 |
| 9 | MPA107 | Introduction to Biology | 3 | 9 | SMPA1007 | Introduction to Biology | 2 |
| 10 | MPA107 | Introduction to Biology | 3 | 10 | SMBI1001 | Practicum of Introduction to Biology | 1 |
| 11 | MPA102 | Introduction to Statistics | 3 | 11 | SMPA1011 | Statistical Methods | 2 |
| 12 | MKS104 | Introduction to Social and Cultural Sciences | 2 | 12 | MKWU1001 | Pancasila | 2 |

| | | | |
|---|---|---|---|
| 13 | MKS101 | Indonesian Language | 2 |
| 14 | MKS201 | English | 2 |
| 15 | MKS105 | Religion Education | 2 |
| 16 | MPA109 | Introduction to Information and Communication Technology | 2 |
| 17 | MKM116 | Basic Chemistry | 4 |
| 18 | MKM116 | Basic Chemistry | 4 |
| 19 | MKM122 | Scientific Mathematics | 2 |
| 20 | MKM124 | Fundamental of Physics | 3 |
| 21 | MKM126 | Laboratory Management | 2 |
| 22 | MKM128 | Principle of Separation Methods | 2 |
| 23 | MKM213 | Physical Chemistry I | 4 |
| 24 | MKM213 | Physical Chemistry I | 4 |
| 25 | MKM211 | Inorganic Chemistry I | 3 |
| 26 | MKM207 | Analytical Chemistry I | 4 |
| 27 | MKM207 | Analytical Chemistry I | 4 |
| 28 | MKM203 | Organic Chemistry I | 4 |
| 29 | MKM203 | Organic Chemistry I | 4 |
| 30 | MKM215 | Biochemistry I | 4 |
| 31 | MKM215 | Biochemistry I | 4 |

| | | | |
|---|---|---|---|
| 13 | MKWU1003 | Indonesian Language | 2 |
| 14 | MKWU1004 | English | 2 |
| 15 | MKWU1007 | Character Building 2 | 0 |
| 16 | SMPA1009 | Introduction to Industrial Revolution | 2 |
| 17 | SMKM1002 | Basic Chemistry | 3 |
| 18 | SMKM1004 | Practicum of Basic Chemistry | 1 |
| 19 | SMKM1006 | Scientific Mathematics | 2 |
| 20 | SMKM1008 | Fundamental of Physics | 3 |
| 21 | SMKM1010 | Laboratory Management | 2 |
| 22 | SMKM1003 | Principle of Separation Methods | 2 |
| 23 | SMKM2005 | Physical Chemistry I | 3 |
| 24 | SMKM2007 | Practicum of Physical Chemistry I | 1 |
| 25 | SMKM2009 | Inorganic Chemistry I | 3 |
| 26 | SMKM2011 | Analytical Chemistry I | 3 |
| 27 | SMKM2013 | Practicum of Analytical Chemistry I | 1 |
| 28 | SMKM2015 | Organic Chemistry I | 3 |
| 29 | SMKM2017 | Practicum of Organic Chemistry I | 1 |
| 30 | SMKM2019 | Biochemistry I | 3 |
| 31 | SMKM2021 | Practicum of | 1 |

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|---|---|---|---|
| | | | |
| 32 | MKS105 | Religion Education | 2 |
| 33 | MKM204 | Physical Chemistry II | 4 |
| 34 | MKM204 | Physical Chemistry II | 4 |
| 35 | MKM214 | Inorganic Chemistry II | 4 |
| 36 | MKM214 | Inorganic Chemistry II | 4 |
| 37 | MKM305 | Analytical Chemistry II | 4 |
| 38 | MKM305 | Analytical Chemistry II | 4 |
| 39 | MKM202 | Organic Chemistry II | 4 |
| 40 | MKM202 | Organic Chemistry II | 4 |
| 41 | MKM218 | Biochemistry II | 4 |
| 42 | MKM218 | Biochemistry II | 4 |
| 43 | MKM313 | Physical Chemistry III | 3 |
| 44 | MKM317 | Inorganic Chemistry III | 4 |
| 45 | MKM317 | Inorganic Chemistry III | 4 |
| 46 | MKM310 | Instrumentation Analysis | 4 |
| 47 | MKM310 | Instrumentation Analysis | 4 |
| 48 | MKM311 | Organic Chemistry III | 3 |

| | | | |
|---|---|---|---|
| | | Biochemistry I | |
| 32 | MKWU2001 | Religion Education | 2 |
| 33 | SMKM2012 | Physical Chemistry II | 3 |
| 34 | SMKM2014 | Practicum of Physical Chemistry II | 1 |
| 35 | SMKM2016 | Inorganic Chemistry II | 3 |
| 36 | SMKM2018 | Practicum of Inorganic Chemistry II | 1 |
| 37 | SMKM2020 | Analytical Chemistry II | 3 |
| 38 | SMKM2022 | Practicum of Analytical Chemistry II | 1 |
| 39 | SMKM2024 | Organic Chemistry II | 3 |
| 40 | SMKM2026 | Practicum of Organic Chemistry II | 1 |
| 41 | SMKM2028 | Biochemistry II | 3 |
| 42 | SMKM2030 | Practicum of Biochemistry II | 1 |
| 43 | SMKM3023 | Physical Chemistry III | 3 |
| 44 | SMKM3025 | Inorganic Chemistry III | 3 |
| 45 | SMKM3027 | Practicum of Inorganic Chemistry III | 1 |
| 46 | SMKM3029 | Instrumentation Analysis | 3 |
| 47 | SMKM3031 | Practicum of Instrumentation Analysis | 1 |
| 48 | SMKM3033 | Organic Chemistry III | 3 |

| | | | |
|---|---|---|---|
| 49 | MKM319 | Structure Elucidation of Organic | 3 |
| 50 | MKM321 | Biochemistry III | 2 |
| 51 | MPAP03 | Entrepreneurship | 2 |
| 52 | MPAP03 | Entrepreneurship | 2 |
| 53 | MKM316 | Physical Chemistry IV | 3 |
| 54 | MKM318 | Organometallics | 2 |
| 55 | MKM321 | Organic Chemistry of Natural Product | 2 |
| 56 | MKM322 | Biochemistry Research Techniques | 2 |
| 57 | MKM319 | Research Methodology | 2 |
| 58 | MKM302 | Colloquium | 2 |
| 59 | MKSP02 | Community Service Program | 2 |
| 60 | MPAP04 | Internship | 3 |
| 61 | MPAPA1 | Research Proposal | 2 |
| 62 | MPAPA2 | Final Project | |
| 63 | MKM507 | Electrochemistry | 2 |
| 64 | MKM509 | Material Chemistry | 2 |
| 65 | MKM511 | Surface Chemistry | 2 |
| 66 | MKM539 | Petroleum Chemistry | 2 |
| 67 | MKM506 | Radiation Chemistry | 2 |
| 68 | MKM525 | Bioinorganic Chemistry | 2 |

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|---|---|---|---|
| 49 | SMKM3035 | Structure Elucidation of Organic | 3 |
| 50 | SMKM3037 | Biochemistry III | 2 |
| 51 | SMPA3013 | Entrepreneurship | 2 |
| 52 | SMPA3015 | Practicum of Entrepreneurship | 1 |
| 53 | SMKM3032 | Physical Chemistry IV | 3 |
| 54 | SMKM3034 | Organometallics | 2 |
| 55 | SMKM3036 | Organic Chemistry of Natural Product | 2 |
| 56 | SMKM3038 | Biochemistry Research Techniques | 2 |
| 57 | SMKM3040 | Research Methodology | 2 |
| 58 | SMKM3042 | Colloquium | 2 |
| 59 | MKWUP001 | Community Service Program | 2 |
| 60 | SMPAP001 | Internship | 3 |
| 61 | SMPAP002 | Research Proposal | 2 |
| 62 | SMPAPA01 | Final Project | 4 |
| 63 | SMKM6039 | Electrochemistry | 2 |
| 64 | SMKM6041 | Material Chemistry | 2 |
| 65 | SMKM6043 | Surface Chemistry | 2 |
| 66 | SMKM6045 | Petroleum Chemistry | 2 |
| 67 | SMKM6047 | Radiation Chemistry | 2 |
| 68 | SMKM6049 | Bioinorganic Chemistry | 2 |

| | | | |
|---|---|---|---|
| 69 | MKM527 | Catalysts | 2 |
| 70 | MKM529 | Mineralogy | 2 |
| 71 | MKM521 | Applied Analytical Chemistry | 2 |
| 72 | MKM523 | Environmental Chemistry | 2 |
| 73 | MKM541 | Halal Chemical Analysis | 2 |
| 74 | MKM519 | Chromatography | 2 |
| 75 | MKM503 | Organic Synthesis | 2 |
| 76 | MKM505 | Bioassay Techniques | 2 |
| 77 | MKM533 | Bioinformatics | 2 |
| 78 | MKM543 | Food Chemistry | 2 |
| 79 | MKM545 | Medicinal Chemistry | 2 |
| 80 | MKM508 | Solid State Chemistry | 2 |
| 81 | MKM510 | Industrial Chemistry | 2 |
| 82 | MKM540 | Polymer Chemistry | 2 |
| 83 | MKM548 | Chemistry of Colloid | 2 |
| 84 | MKM520 | Chemometrics | 2 |
| 85 | MKM524 | Coordination Chemistry | 2 |
| 86 | MKM526 | Capita Selecta in Inorganic Chemistry | 2 |
| 87 | MKM528 | Inorganic Synthesis | 2 |
| 88 | MKM552 | Electrometric | 2 |

| | | | |
|---|---|---|---|
| 69 | SMKM6051 | Catalysts | 2 |
| 70 | SMKM6053 | Mineralogy | 2 |
| 71 | SMKM6055 | Applied Analytical Chemistry | 2 |
| 72 | SMKM6057 | Environmental Chemistry | 2 |
| 73 | SMKM6059 | Chemical Analysis of Halal Products | 2 |
| 74 | SMKM6061 | Introduction of Chromatography | 2 |
| 75 | SMKM6063 | Introduction to Organic Synthesis | 2 |
| 76 | SMKM6065 | Basic Bioassay Technology | 2 |
| 77 | SMKM6067 | Bioinformatics | 2 |
| 78 | SMKM6069 | Food Chemistry | 2 |
| 79 | SMKM6071 | Medicinal Chemistry | 2 |
| 80 | SMKM6044 | Solid State Chemistry | 2 |
| 81 | SMKM6046 | Industrial Chemistry | 2 |
| 82 | SMKM6048 | Polymer Chemistry | 2 |
| 83 | SMKM6050 | Chemistry of Colloid | 2 |
| 84 | SMKM6052 | Computational Chemistry | 2 |
| 85 | SMKM6054 | Coordination Chemistry | 2 |
| 86 | SMKM6056 | Capita Selecta in Inorganic Chemistry | 2 |
| 87 | SMKM6058 | Inorganic Synthesis | 2 |
| 88 | SMKM6060 | Sensors and | 2 |

| | | | |
|---|---|---|---|
| | | Analysis | |
| 89 | MKM520 | Chemometrics | 2 |
| 90 | MKM522 | Advanced Separation Techniques | 2 |
| 91 | MKM536 | Environmental Impact Assessment | 3 |
| 92 | MKM546 | Chemical Analysis of Waste | 2 |
| 93 | MKM504 | Organic Stereo Chemistry | 2 |
| 94 | MKM538 | Secondary Metabolite Analysis | 2 |
| 95 | MKM512 | Microbiology | 2 |
| 96 | MKM514 | Fermentation Technology | 2 |
| 97 | MKM542 | Biotechnology | 2 |
| 98 | MKM536 | Environmental Impact Assessment | 3 |
| 99 | MPAP05 | Entrepreneurial Practice | 18 |
| 100 | MPAP06 | Scientific Publication | 11 |
| 101 | MPAP07 | Industrial Internship A | 17 |
| 102 | MPAP08 | Industrial Internship B | 11 |
| 103 | MPAP08 | Industrial Internship C | 5 |

| | | | |
|---|---|---|---|
| | | Biosensors | |
| 89 | SMKM6062 | Chemometrics | 2 |
| 90 | SMKM6064 | Advanced Separation Techniques | 2 |
| 91 | SMKM6066 | Environmental Impact Assessment | 2 |
| 92 | SMKM6068 | Waste Treatment | 2 |
| 93 | SMKM6070 | Organic Stereo Chemistry | 2 |
| 94 | SMKM6072 | Secondary Metabolite Analysis | 2 |
| 95 | SMKM6074 | Microbiology | 2 |
| 96 | SMKM6076 | Fermentation Technology | 2 |
| 97 | SMKM6078 | Biotechnology | 2 |
| 98 | SMKM6080 | Practicum of Environmental Impact Assessment | 1 |
| 99 | SMPA6001 | Entrepreneurial Practice | 17 |
| 100 | SMPA6002 | Scientific Publication | 11 |
| 101 | SMPA6003 | Industrial Internship A | 17 |
| 102 | SMPA6004 | Industrial Internship B | 11 |
| 103 | SMPA6004 | Industrial Internship B | 11 |

| | | | |
|---|---|---|---|
| 104 | MPAP10 | Village Project A | 18 |
| 105 | MPAP11 | Village Project B | 12 |
| 106 | MPAP12 | Village Project C | 6 |
| 107 | MPAP13 | Science Teaching Practice A | 18 |
| 108 | MPAP14 | Science Teaching Practice B | 12 |
| 109 | MPAP15 | Science Teaching Practice C | 6 |

| | | | |
|---|---|---|---|
| 104 | SMPA6005 | Village Project A | 18 |
| 105 | SMPA6006 | Village Project B | 12 |
| 106 | SMPA6006 | Village Project B | 12 |
| 107 | SMPA6007 | Science Teaching Practice A | 16 |
| 108 | SMPA6008 | Science Teaching Practice B | 12 |
| 109 | SMPA6008 | Science Teaching Practice B | 12 |

3.8.2 Recognition of Courses

The Bachelor in Chemistry Program offers more than 20% of its total courses as elective courses. Therefore, the program does not require the use of University-wide Recognition Courses (Ind.:MKRU).

### 3.9 Examples of Course Design Using Case Method and PjBL

**1.** Example of a Semester Learning Plan (RPS) of Case Method-based Course

## SEMESTER LEARNING PLAN (RPS)
## ORGANIC CHEMISTRY NATURAL MATERIALS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | UNIVERSITAS SYIAH KUALA<br>FMIPA<br>BACHELOR IN CHEMISTRY STUDY PROGRAM | | | | | | Document Code :<br>47201-055-02-13 | |
| **Courses** | **Course Code** | **Category** | **Prerequisite** | **Course Cluster** | **Credits (SKS)** | | **Semester** | **Date of Compilation** |
| Organic Chemistry of Natural Product | SMKM3036 | Compulsory | SMKM2015 | Organic Chemistry | T= 2 | P= 0 | 6 | July 17, 2024 |
| Authorization | | RPS Development Coordinator | | Course Coordinator | | | Program Coordinator | |
| | | Prof. Dr. Mustanir M.Sc | | Muhammad Bahi, S.Sc., M.Sc., Ph.D. | | | Dr. Khairi, M.Si | |
| Supporting lecturer | | Organic Chemistry Teaching Team | | | | | | |
| Course Description | | This course explains the classification of secondary metabolite compounds produced by natural resources, especially plants. The classification of secondary metabolites based on their chemical structures, followed by an introduction to their biosynthetic pathways, characteristic chemical reactions of each metabolite group, and the physiological and bioactive properties specific to each class. | | | | | | |
| Learning Outcomes | | Intended Learning Outcomes (ILO) aligned with this course | | | | | | |
| | | ILO02 | Demonstrate effective communication skills, problem-solving abilities, teamwork within diversity, and potential for commercialization of chemical knowledge and skills. | | | | | |
| | | ILO05 | Possess fundamental knowledge in mathematics and science, core knowledge in chemistry, and relevant interdisciplinary knowledge, with the ability to integrate and apply them to solve real-world problems. | | | | | |
| | | Course Learning Outcomes (CLO) | | | | | | |
| | | CPOR09 | Demonstrate the ability to perform synthesis and analyze the biosynthetic pathways of organic compounds. | | | | | |
| | | CPOR10 | Demonstrate the ability to identify secondary metabolites based on their properties, reactions, and applications. | | | | | |

Correlation Matrix of ILO and CLO

Correlation of ILO to CLO

| CLO | ILO (%) | | | CLO Weight (%) |
|---|---|---|---|---|
| | CPL01 | CPL02 | CPL05 | |
| CPOR03 | 20 | - | - | 20 |
| CPOR09 | - | 30 | - | 30 |
| CPOR10 | - | - | 50 | 50 |
| ILO Weight (%) | 20 | 30 | 50 | 100 |

CLO Compliance Matrix to University Vision, SDGs, and Research Based Learning (RBL)

Correlation of CLO to University Vision, SDGs, and Research-Based Learning

| Aspect | CPMK | |
|---|---|---|
| | CPOR09 | CPOR10 |
| Socio-Technopreneur | - | - |
| SDGs Target | - | 13 |
| Research Base Learning | - | - |

Course Topics / Learning Content

1. Terpenoid Chemistry
2. Steroid Chemistry
3. Phenylpropanoid and Polyketide Chemistry
4. Flavonoid Chemistry
5. Tannin Chemistry
6. Alkaloid Chemistry

1

| | |
|---|---|
| Learning Library | Main:<br>1. Fesenden, RJ and Fesenden, JS (Translated by AH Pudjaatmaka) (1989) Organic Chemistry, volumes 1 and 2, Erlangga.<br>2. McMurry, J., (2005), "Organic Chemistry," Brooks/Cole Publishing Company, Pacipic Grove, California, 5th edition.<br>3. Arun Bahl and BS Bahl, (2019), Textbook of Organic Chemistry, 2nd Edition. |
| | Supporting: Journals, other textbooks and organic chemistry e-books related to the topic of discussion |

Assessment

Assessment Criteria and Items

| Score Range | Quality Letter | Category | Course Completion Status |
|---|---|---|---|
| ≥B7 | A | Excellent | Pass |
| 7B - <B7 | AB | Distinction | |
| 69 - <7B | B | Good | |
| 60 - <69 | BC | Fairly good | |
| 51 - <60 | C | Fair | |
| 41 - <51 | D | Poor | Fail |
| <41 | E | Fail | |

Evaluation Plan

| Learning methods | Case Method/Team-Based Project | √ | Non Case Method/Team -Based Project | |
|---|---|---|---|---|

| Evaluation Basis | Evaluation Components | Weight Distribution /CPMK (%) | | | Total Weight Case Method/ Team-Based Project | Total Weight Non-Case Method |
|---|---|---|---|---|---|---|
| | | CPOR 03 | CPOR 09 | CPOR 10 | | |
| | | 20 | 30 | 30 | | |
| Participatory Activities | Case Method | 50 | 50 | 50 | 50 | |
| Project Results | Team-Based Project | 0 | 0 | 0 | 0 | |
| Cognitive and affective | Assignment | 20 | 20 | 20 | | 20 |
| Cognitive | Mid-term exam | 30 | 30 | 20 | | 30 |
| Total CLO Weight | | 100 | 100 | 100 | 50 | 50 |
| Learning Methods | | Case Method/Team-Based Project | | | | |

**SCHEDULE, TOPICS DESCRIPTION AND LECTURE ACTIVITIES**

| Week | Student Learning Stages (Sub-CLO) | Assessment | | Learning Forms, Learning Methods, and Student Assignments (time estimates) | | Course Topics | Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Techniques | *Offline* | *Online* | | |
| 1 | Students demonstrate the understanding of the fundamental theory regarding the structure and biosynthesis of terpenoid compounds. | Demonstrate the ability to accurately and correctly answer exam questions and assignments related to the structure and biosynthesis of terpenoid compounds | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving.<br>• Students individually complete assignments on the structure and biosynthesis of terpenoid compounds. | | **Terpenoid Chemistry**<br>• Classification and structure of Terpenoids<br>• Bioactive properties of terpenoid compounds<br>• Biosynthesis of Terpenoid Compounds | 7% (cognitive: 5%, affective: 2%) |
| 2 | Students are able to explain and present the structural | Demonstrate the ability to answer exam questions | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI) | | **Steroid Chemistry**<br>• Classification and structure of | 7% (cognitive: 5%, affective: |

2

| Week | Student Learning Stages (Sub-CLO) | Assessment | | Learning Forms, Learning Methods, and Student Assignments (time estimates) | | Course Topics | Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Techniques | *Offline* | *On line* | | |
| | characteristics and biosynthetic pathways of steroid compounds. | and assignments related to the structure and biosynthesis of steroid, phenylpropanoid, and polyketide compounds | | Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments on the structure and biosynthesis of steroid, phenylpropanoid and polyketide compounds. | | steroids<br>• Bioactive properties of steroid compounds<br>• Biosynthesis of Steroid Compounds | 2%) |
| 3 and 4 | Students are able to explain the biosynthetic pathways of compounds belonging to the phenylpropanoid and polyketide groups. | Demonstrate the ability to explain the biosynthetic pathways of phenylpropanoid and polyketide compounds through written assessments or examinations | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments on the biosynthesis of phenylpropanoid and polyketide compounds. | | **Phenylpropanoid Chemistry and**<br>• Classification and structure of phenylpropanoids and polyketides<br>• Bioactive properties of phenylpropanoid and polyketide compounds<br>• Biosynthesis of Phenylpropanoid and Polyketide Compounds | 14% (cognitive: 10%, affective: 4%) |
| 5 | Students are able to describe the structure and biosynthesis of flavonoid compounds. | Demonstrate the ability to answer questions related to the structure and biosynthesis of flavonoid compounds with clarity and accuracy | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments on the structure and biosynthesis of flavonoid compounds. | | **Flavonoid Chemistry**<br>• Classification and structure of Flavonoids<br>• Bioactive properties of Flavonoid compounds<br>• Biosynthesis of Flavonoid compounds | 7% (cognitive: 5%, affective: 2%) |

3

| Week | Student Learning Stages (Sub-CLO) | Assessment | | Learning Forms, Learning Methods, and Student Assignments (time estimates) | | Course Topics | Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Techniques | *Offline* | *On line* | | |
| 6 | Students are able to describe the structure and biosynthesis of tannin compounds. | Demonstrate the ability to analyze and describe the structure and biosynthesis of tannin compounds in the context of academic assessments | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments on the structure and biosynthesis of tannin compounds. | | **Tannin Chemistry**<br>• Classification and structure of tannins<br>• Bioactive properties of tannin compounds<br>• Biosynthesis of Tannin Compounds | 8% (cognitive: 6%, affective: 2%) |
| 7 | Students are able to explain the structure and biosynthesis of alkaloid compounds. | Demonstrate the ability to understand and explain the structural classification and biosynthesis of alkaloid compounds in written evaluations | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments about structure and biosynthesis of alkaloid compounds | | **Alkaloid Chemistry**<br>• Classification and structure. Alkaloids<br>• Bioactive properties of alkaloid compounds<br>• Biosynthesis of Alkaloid Compounds | 7 % (cognitive: 5%, affective: 2 %) |
| 8 | **Mid-term exam = 30% Assignments = 20%** | | | | | | 50% |
| 9 | Students demonstrate the understanding of the principles of scientific reporting and oral presentation in the context of journal analysis. | | | Model : *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion | | **Instructions for writing journal analysis papers and presentations** | |
| 10-16 | Students are able to:<br>1. Analyze journals related to the properties, structure, biosynthesis and uses of compounds in the terpenoid, steroid, phenylpropanoid, polyketide, flavone groups. tannins, coumarins and alkaloid<br>2. Report the results of | Demonstrate the ability to prepare scientific reports and present journal analysis findings related to secondary metabolite compounds with precision and clarity. | Assessment techniques through reports and presentations | Model and method : Case *Method*<br>Approach : Process skills through presentation | | Reputable international journal | 50% (cognitive: 40%, affective: 10%) |

4

| Week | Student Learning Stages (Sub-CLO) | Assessment | | Learning Forms, Learning Methods, and Student Assignments (time estimates) | | Course Topics | Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Techniques | *Offline* | *On line* | | |
| | secondary metabolite journal analysis in the form of reports and presentations. | | | | | | |
| **TOTAL WEIGHT** | | | | | | | **100%** |

5

2. Example of a Semester Learning Plan (RPS) of Project-Based Learning (PjBL) Course

# SEMESTER LEARNING PLAN (RPS)
# SECONDARY METABOLITES ANALYSIS

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | UNIVERSITAS SYIAH KUALA<br>FMIPA<br>BACHELOR IN CHEMISTRY STUDY PROGRAM | | | | | Document Code :<br>47201-094-01-00 | |
| **Course** | **Course Code** | **Category** | **Prerequisite** | **Course Cluster** | **Credits (SKS)** | | **Semester** | **Date of Compilation** |
| Secondary Metabolite Analysis | SMKM6072 | Elective | SMKM2015 | Organic Chemistry | T= 2 | P= 0 | 6 | July 17, 2024 |
| Authorization | | RPS Development Coordinator | | Course Coordinator | | | Program Coordinator | |
| | | Prof. Dr. Nurdin, M.Si | | Prof. Dr. Nurdin, M.Si | | | Dr. Khairi, M.Si | |
| Supporting lecturer | | Organic Chemistry Teaching Team | | | | | | |
| Course Description | | This course introduces the identification of secondary metabolite sources, techniques for plant sample handling, phytochemical screening, and analytical approaches such as extraction, isolation, and structure elucidation. It also includes journal-based discussions on organic compounds derived from plant-based natural products. | | | | | | |
| Learning Outcomes | | Intended Learning Outcomes (ILO) aligned with this course | | | | | | |
| | | ILO03 | Demonstrate the ability to perform chemical experiments in a safe, ethical, and responsible manner, with proficiency in managing, processing, and interpreting experimental data. | | | | | |
| | | ILO05 | Possess a solid foundation in mathematics, natural sciences, and core chemistry concepts, with the ability to integrate knowledge across disciplines to address complex scientific problems. | | | | | |
| | | Course Learning Outcomes (CLO) | | | | | | |
| | | CPOR06 | Capable of explaining fundamental principles and methodologies in organic chemistry, including the procedures and techniques used for the characterization of organic molecules | | | | | |
| | | CPOR10 | Able to identify secondary metabolites through an understanding of their chemical properties, reactivity, and potential applications. | | | | | |

Correlation Matrix of ILO and CLO

Correlation of ILO to CLO

| CLO | ILO (%) | | CLO Weight (%) |
|---|---|---|---|
| | CPL03 | CPL05 | |
| CPOR06 | 10 | 20 | 30 |
| CPOR10 | 50 | 20 | 70 |
| ILO Weight (%) | 60 | 40 | 100 |

CLO Compliance Matrix to University Vision, SDGs, and Research-Based Learning (RBL)

Correlation of CLO to University Vision, SDGs, and RBL

| Aspect | CPMK | |
|---|---|---|
| | CPOR06 | CPOR10 |
| Socio-Technopreneur | - | - |
| SDGs Target | - | - |
| Research Base Learning | - | - |

Course Topics / Learning Content

1. Sources of secondary metabolite compounds
2. Sampling and handling plant samples
3. Identification of organic compound components in plants
4. Bioactive properties of secondary metabolite compounds, methods of extraction and isolation of organic compounds from plants

Learning Library

Main:

1. Rensheng Xu, Yang Ye and Weimin Zhao; (2011); Introduction to Natural Products Chemistry; first edition; CRC Press.
2. Harborne, JB, 1998, Phytochemical Methods A Guide to Modern Techniques of Plant Analysis, 3rd edition, NewYok

Supporting: Journals, other textbooks and organic chemistry e-books related to the topic of discussion

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<table>
<tr><td rowspan="9">Assessment</td><td colspan="6">Assessment Criteria and Items</td></tr>
<tr><td colspan="2">Score Range</td><td>Quality Letter</td><td>Category</td><td colspan="2">Course Completion Status</td></tr>
<tr><td colspan="2">≥87</td><td>A</td><td>Excellent</td><td colspan="2" rowspan="5">Pass</td></tr>
<tr><td colspan="2">78 - <87</td><td>AB</td><td>Distinction</td></tr>
<tr><td colspan="2">69 - <78</td><td>B</td><td>Good</td></tr>
<tr><td colspan="2">60 - <69</td><td>BC</td><td>Fairly good</td></tr>
<tr><td colspan="2">51 - <60</td><td>C</td><td>Fair</td></tr>
<tr><td colspan="2">41 - <51</td><td>D</td><td>Poor</td><td colspan="2" rowspan="2">Fail</td></tr>
<tr><td colspan="2"><41</td><td>E</td><td>Fail</td></tr>
<tr><td rowspan="11">Evaluation Plan</td><td>Learning methods</td><td colspan="2">Case Method/Team-Based Project</td><td>√</td><td>Non Case Method/ Team-Based Project</td><td></td></tr>
<tr><td rowspan="2">Evaluation Basis</td><td rowspan="2">Evaluation Components</td><td colspan="2">Weight Distribution /CPMK (%)</td><td rowspan="2">Total Weight Case Method/ Team-Based Project</td><td rowspan="2">Total Weight Non-Case Method</td></tr>
<tr><td>CPOR06</td><td>CPOR10</td></tr>
<tr><td></td><td></td><td>30</td><td>70</td><td></td><td></td></tr>
<tr><td>Participatory Activities</td><td>Case Method</td><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>Project Results</td><td>Team-Based Project</td><td>50</td><td>50</td><td>50</td><td></td></tr>
<tr><td>Cognitive and affective</td><td>Assignment</td><td>20</td><td>20</td><td></td><td>20</td></tr>
<tr><td>Cognitive</td><td>Mid-term exam</td><td>30</td><td>30</td><td></td><td>30</td></tr>
<tr><td colspan="2">Total CLO Weight</td><td>100</td><td>100</td><td>50</td><td>50</td></tr>
<tr><td colspan="2">Learning Methods</td><td colspan="2">Case Method/Team-Based Project</td><td colspan="2"></td></tr>
</table>

**SCHEDULE, TOPICS DESCRIPTION AND LECTURE ACTIVITIES**

| Week | Student Learning Stages (Sub-CLO) | Assessment | | Learning Forms, Learning Methods, and Student Assignments (time estimates) | | Course Topics | Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Techniques | *Offline* | *On line* | | |
| 1 | Students demonstrate the ability to determine various natural sources of secondary metabolite compounds | Able to answer exam or assignment questions about sources of secondary metabolite compounds | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving.<br>• Students individually complete assignments on sources of secondary metabolite compounds. | | **Sources of secondary metabolite compounds** | 8% (cognitive: 6%, affective: 2%) |
| 2 and 3 | Students possess both theoretical understanding and practical competence in the collection and handling of plant samples. | Able to answer exam or assignment questions about plant sample collection and handling techniques | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments about techniques | | **Sampling and handling plant samples**<br>• Preparation and completeness of equipment for sampling<br>• Handling of plant samples | 14% (cognitive: 12%, affective: 2%) |

2

| Week | Student Learning Stages (Sub-CLO) | Assessment | | Learning Forms, Learning Methods, and Student Assignments (time estimates) | | Course Topics | Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Techniques | *Offline* | *On line* | | |
| | | | | for taking and handling plant samples | | | |
| 4 and 5 | Students are able and skilled in identifying the components of secondary metabolite compounds in plants. | Able to answer exam questions or assignments about secondary metabolite compound components in plants | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments on the components of secondary metabolite compounds in plants. | | **Identification of organic compound components in plants**<br>• Terpenoid and steroid test<br>• Phenol and flavonoid test<br>• Alkaloid and saponin test | 14% (cognitive: 12%, affective: 4%) |
| 6 and 7 | Students are able to apply plant analysis methods and are skilled at separating and purifying organic compounds. | Able to answer exam questions or assignments about separating and purifying organic compounds | Assessment technique via essay test | Model : *Problem based instruction* (PBI) and *Direct Instruction* (DI)<br>Approach : Process skills<br>Method : Lecture & discussion and assignment giving<br>• Students individually complete assignments on separating and purifying organic compounds. | | **Bioactive properties of secondary metabolite compounds, methods of extraction and isolation of organic compounds from plants**<br>• Extraction and Isolation<br>• Identification Purification | 14% (cognitive: 12%, affective: 2%) |
| 8 | **Exam I = 30% Assignment = 20%** | | | | | | 50% |
| 9-16 | Students are able to:<br>1. Collect samples<br>2. Design a work plan for secondary metabolite analysis<br>3. Carrying out work: phytochemical analysis, extraction, isolation and purification of secondary metabolites in groups<br>4. Presenting work results in group seminars and making reports | Able to conduct sampling, design work, conduct analysis, make reports and present the results of secondary metabolite analysis | Assessment techniques through accuracy of reports and percentages | Models and Methods : Project Based Learning<br>Approach : Process skills | | Reputable international journal<br>Books, both e-books and textbooks | 50% (cognitive: 40%, affective: 10%) |
| **TOTAL WEIGHT** | | | | | | | 100% |

## 3.10 Example of a Course Contract/ Course Agreement

**UNIVERSITAS SYIAH KUALA**
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| **DOCUMENT: COURSE AGREEMENT** | | | |
|---|---|---|---|
| **Code** : 094/UN.11.2 /PKIM/KK/2024 | | **Date of issue** | : August 10 2024 |
| **Area** : | **Bachelor in Chemistry**<br>**Faculty of Mathematics and Natural Sciences, USK** | **Revision No.** | :1 |

| | |
|---|---|
| Course Name | : Secondary Metabolite Analysis |
| Course Code | :SMKM6072 |
| Credit Weight | : 2 |
| Semester | : 6 |
| Course Status | : Elective |
| Class | : A |
| Meeting Day | : Thursday, 4:35-6:15 PM |
| Meeting Place | : Room B.01.02 and Organic Chemistry Laboratory |
| MK Coordinator | : Prof. Dr. Nurdin Saidi, M. Si |
| MK Advisory Team | : 1. Prof. Dr. Nurdin Saidi, M. Si<br>2. Prof. Binawati Ginting, M.Si |

**1. Course Outcomes**

1. Students can identify sources of secondary metabolite compounds.
2. Students are able to analyze secondary metabolite compounds in plants
3. Students are skilled at collecting, handling, extracting, isolating secondary plant metabolite compounds.
4. As a reference for research in the field of organic chemistry

**2. Course Description**

Identification of sources of secondary metabolite compounds, collection and handling of plant samples, phytochemical identification techniques for secondary metabolites, plant analysis methods (extraction, isolation, elucidation) and discussion of journals related to organic compounds from natural materials from plants.

**3. Graduate Learning Outcomes (CPL)**

ILO03 : To conduct chemical experiments independently and responsibly, as well as to manage, analyze, and interpret the resulting data
ILO05: To understand foundational concepts in chemistry, mathematics, and other natural sciences, and to proficiently apply this integrated knowledge to resolve everyday challenges

**4. Learning strategies**

Learning Methods/Models:Problem Base Introduction (PBI), Direct Instruction (DI),and Case Method.

**5. Subject matter**

1. Sources of secondary metabolite compounds
2. Taking and handling plant samples
3. Identification of organic compound components in plants.
4. Bioactive properties of secondary metabolite compounds, methods of extraction and isolation of organic compounds from plants

**6. Reading/Reference Materials**

1. Rensheng Xu, Yang Ye and Weimin Zhao; (2011); Introduction to Natural Products Chemistry; first edition; CRC Press.
2. Harborne, JB, 1998, Phytochemical Methods A Guide to Modern Techniques of Plant Analysis, 3rd edition, New York.
3. Journal related to secondary metabolite analysis.

**7. Task**

Solve questions related to course study materials.

**8. Assessment Criteria and Standards**

*Project-based learning* = 50%; assignment = 20%;
Mid-term exam=30%;

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| Score Range | Quality Letter | Category | Graduation Status |
|---|---|---|---|
| ≥87 | A | Excellent | PASS |
| 78 - <87 | AB | Distinction | |
| 69 - <78 | B | Good | |
| 60 - <69 | BC | Fairly good | |
| 51 - <60 | C | Fair | |
| 41 - <51 | D | Poor | FAIL |
| <41 | E | Fail | |

**9. Lecturer and Student Rules of Procedure**

Lecturer :
1. Begin and end each class session on time (a tolerance of up to 15 minutes for delay is acceptable)
2. Dress appropriately and modestly in accordance with cultural and religious values
3. Maintain professional and ethical behavior in speech and actions; uphold the principles of "Pancasila" and the Republic of Indonesia
4. Return midterm and final examination results to students within a reasonable period.
5. Do not alter or reschedule classes except when absolutely necessary
6. Ensure full attendance throughout the semester
7. Comply with the academic regulations of Universitas Syiah Kuala (USK) and the Faculty of Mathematics and Natural Sciences
8. Classes should not be conducted on public holidays unless strictly required and approved.

Student:
1. Arrive and leave the classroom punctually (with a tolerance of up to 15 minutes for lateness)
2. Dress modestly according to religious and cultural traditions.
3. Maintain respectful behavior and language, upholding the values of Pancasila and the Republic of Indonesia.
4. Refrain from using mobile phones, laptops, or any communication devices during lectures and examinations.
5. Avoid causing disturbances, noise, or distractions during class.
6. Attend at least 75% of total class sessions held by the lecturer to be eligible for assessment.
7. Adhere to the academic regulations of Syiah Kuala University (USK) and the Faculty of Mathematics and Natural Sciences.
8. Keep the classroom clean and tidy at all times.
9. After each lecture, ensure that electricity, LCD projectors, and other equipment are turned off, the whiteboard is cleaned, and trash is properly disposed of.
10. Do not engage in activities unrelated to the course during lectures.
11. A follow-up exam can be carried out if you meet the applicable terms and conditions and can show proof.

**10. course schedule**

| Week To | Subject | Teaching Lecturer |
|---|---|---|
| 1 | Sources of secondary metabolite compounds | Prof. Dr. Nurdin Saidi, M.Si |
| 2 and 3 | Taking and handling plant samples | Prof. Dr. Nurdin Saidi, M.Si |
| 4 and 5 | Identification of organic compound components in plants | Prof. Dr. Nurdin Saidi, M.Si |
| 6 and 7 | Bioactive properties of secondary metabolite compounds, methods of extraction and isolation of organic compounds from plants | Prof. Dr. Nurdin Saidi, M.Si |
| 8 | Mid-term exam | Prof. Dr. Nurdin Saidi, M.Si |
| 9-16 | Conducting lectures through*Project-based learning* | Prof. Dr. Binawati Ginting, M.Si |

**11. Evaluation**

**A. Work Plan Assessment Rubric:**

| No | Assessment Aspects | Assessment Score | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 87-100 | 78-86 | 69-77 | 60-68 | 51-59 | 41-50 | <41 |
| 1 | Writing a work plan | The work plan is | The work plan is | The work plan is | The work plan uses | The work plan shows | The work plan | The work plan is |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (systematics, language) (80%) | written in clear, precise, and highly systematic academic language | written in clear and appropriate academic language, though slightly less systematic | written in generally clear language but lacks coherence and systematic flow | inconsistent language and lacks clarity and organization. | poor language use and weak organization | demonstrates unclear, inaccurate, and disorganized writing. | written in unclear, incoherent, and disorganized language |
| 2 | Reference sources (20%) | All references are from reputable international journals and within the last 5 years. | Some of the references come from reputable international journals and the last 10 years. | Some of the references come from reputable international journals and the last 15 years. | All references are from international journals and the last 5 years. | All references are from international journals and the last 10 years. | All references are from international journals and the last 10 years. | All references are from national journals and the last 10 years |

**Work Plan Value (A) = Score (aspect 1 x 0.8) + score of aspect 2 x 0.2)**

**B. Work Skills Assessment Rubric**

| No | Assessment Aspects | Assessment Score | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 87-100 | 78-86 | 69-77 | 60-68 | 51-59 | 41-50 | <41 |
| 1 | Discipline (20%) | Performs tasks strictly according to the approved work plan in a highly systematic and organized manner | Performs tasks according to the work plan with minor lapses in organization | Performs tasks less consistently with the work plan and shows limited systematic approach | Performs tasks inconsistently and lacks organization | Performs tasks without following the work plan and with poor organization | Rarely follows the work plan and demonstrates disorganized work. | Fails to carry out assigned tasks or does not participate in activities |
| 2 | Perseverance and skill (60%) | Carries out all procedures accurately and completely as stated in the work plan | Completes approximately 80% of the procedures according to the work plan | Completes approximately 70% of the procedures according to the work plan. | Completes about 60% of the procedures according to the work plan | Completes only around 50% of the procedures according to the work plan | Completes less than 40% of the procedures according to the work plan | Fails to perform the required activities |
| 3 | Teamwork and cooperation (20%) | Actively participates in group activities and consistently takes initiative. | Participates actively but shows limited initiative. | Participates occasionally with insufficient initiative. | Participates minimally and lacks initiative. | Rarely participates and shows no initiative. | Does not participate or contribute to teamwork. | Completely fails to participate in assigned group tasks. |

**Work skills score (B) = Score (aspect 1 x 0.2) + (score of aspect 2 x 0.6) + (score of aspect 3 x 0.2)**

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C. **Assessment rubric for reports and presentations of work results**

| No | Assessment Aspects | Assessment Score | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | B7-100 | 7B-B6 | 69-77 | 60-6B | 51-59 | 41-50 | <41 |
| 1 | Writing and language (20%) | The report is written in accurate and fluent Indonesian, fully compliant with academic language standards and easy to understand. | The report mostly complies (≈80%) with Indonesian academic language standards and is generally easy to understand | The report complies (≈70%) with Indonesian academic language standards but contains several language errors affecting clarity | The report shows partial compliance (≈60%) with Indonesian academic language standards and lacks clarity | The report has limited compliance (≈50%) with Indonesian academic language standards and is difficult to understand | The report has minimal compliance (≈40%) with Indonesian academic language standards and is poorly written | No report submitted or activity not performed |
| 2 | Results/data and discussion (30%) | The data and discussion are complete, accurate, and well-analyzed. | The data and discussion are 80% complete and relevant | The data and discussion are 70% complete, with minor analysis gaps. | The data and discussion are 60% complete and lack depth. | The data and discussion are 50% complete, with weak analysis | The data and discussion are 40% complete, poorly organized, and lack interpretation | No results or discussion presented |
| 3 | Slides and Presentation Techniques (20%) | The slides are highly engaging, well-designed, and informative; presentation is clear and confident | The slides are engaging and informative (≈80%), with minor design or delivery issues | The slides are fairly engaging and informative (≈70%), but presentation lacks fluency | The slides are adequate (≈60%) but lack visual appeal or clarity. | The slides are poorly designed (≈50%) and difficult to follow | The slides are poorly organized (≈40%) with unclear delivery | No slides prepared or presentation not conducted. |
| 4 | Mastery of material (30%) | Demonstrates excellent understanding of the material and its theoretical background; answers questions accurately and confidently | Demonstrates good understanding (≈80%) of the material with minor errors in theoretical explanation | Demonstrates adequate understanding (≈70%) of the material; explanation somewhat limited | Demonstrates partial understanding (≈60%) of the material; lacks confidence in explanation | Demonstrates weak understanding (≈50%) and limited ability to relate theory to data. | Demonstrates very limited understanding (≈40%) of the material and weak interpretation. | No mastery demonstrated or activity not performed |

**Report and presentation score (C) = Score (aspect 1 x 0.2) + (aspect 2 x 0.3) + (aspect 3 x 0.2) + (aspect 4 x 0.3)**

Total value of the Project based learning model = Value (A x 0.2 + B x 0.35 + C x 0.45)

**Total Course Value**:Theoretical grade: (Assignment = 10%; Mid-term exam = 40%; Project based learning grade = 50%)

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**12. Miscellaneous**

Any matters not covered in this agreement may be discussed and addressed technically during the course sessions. If revisions to the contents of this course agreement are deemed necessary, they shall be discussed and mutually agreed upon prior to implementation. This course agreement shall take effect from the date it is submitted and signed by both parties.

| | |
|---|---|
| Party **I**<br>Class Coordinator, | Party **II**<br>On behalf of Students/Committee |
| Dr. Nurdin Saidi, M.Si<br>NIP. 196609151991031005 | (.....)<br>Student ID. |

Agree,
head of the study program

Dr. Khairi, M.Si.
NIP.196906141999031002

# CHAPTER 4
# RANCANGAN EVALUASI PROGRAM PEMBELAJARAN

## 4.1 Correlation Between Graduate Profiles and Learning Outcomes (ILO)

The level of depth and breadth of the correlation between Graduate Profiles (PL) and Intended Learning Outcomes (ILO) is determined through a relevance analysis. The degree of relevance is indicated by the letters H (High) for values between 71–100, M (Medium) for values between 41–70, and L (Low) for values between 0–40. The Chemistry Study Program demonstrates correlations between the PLs and ILOs at both High and Medium levels, as shown in Table 4.1.

Table 4.1. Matrix of Correlation between Graduate Profiles and ILOs

| Graduate Profiles | PL01 | PL02 |
|---|---|---|
| ILO01 | H | M |
| ILO02 | H | M |
| ILO03 | H | H |
| ILO04 | M | H |
| ILO05 | M | H |

**Note: The assignment of ILO and PL codes is determined by each study program*
** Legend: L = Low (0–40), M = Medium (41–70), H = High (71–100)*

The correlation between components of the Graduate Competency Standards (SKL) also supports the analysis of ILOs in the Bachelor of Chemistry Study Program. The SKL components, based on the Indonesian National Qualification Framework (KKNI), consist of Attitude and Values (ST), General Skills (KU), Specific Skills (KK), and Knowledge Mastery (PP). Table 4.2 presents the correlation between these components and the ILOs.

Table 4.2. Matrix of Correlation between Intended Learning Outcomes-ILO (SNDikti/KKNI) and SKL Components

| Component of SKL | ILO01 | ILO02 | ILO03 | ILO04 | ILO05 |
|---|---|---|---|---|---|
| Attitudes and Values (ST) | √ | √ | | | |
| General Skills (KU) | | √ | | | √ |
| Specific Skills (KK) | | | √ | √ | √ |
| Knowledge Mastery (PP) | | | √ | √ | √ |

## 4.2 Correlation Between Courses and Intended Learning Outcomes (ILO)

The formulation of ILO requires the identification of subject areas, which are then used to map Course Learning Outcomes (CPMK) and develop corresponding courses. Each course must be mapped to the ILO to calculate the contribution weight. This mapping is presented in a matrix, as shown in Table 4.3.

In Table 4.3, ILOs are coded as ILO01, ILO02, ILO03, ILO04, and ILO05. For example, the General Chemistry course contributes to the achievement of ILO02, ILO03, and ILO05. The course has a credit weight of 3 credits, and the teaching team has allocated equal contribution weights: ILO02 (33.3%), ILO03 (33.3%), and ILO05 (33.3%). To calculate the assessment weight for each ILO in this course, the credit contribution is divided by the total ILO credit load (197). For instance, if ILO02 has a total weight of 52, ILO03 is 10, and ILO05 is 87, then the percentage contributions are calculated as follows:

- ILO02: (52/197) × 100% = 26.78%
- ILO03: (10/197) × 100% = 11.17%
- ILO05: (87/197) × 100% = 44.16%

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Table 4.3. Weighting Matrix for the Assessment of Intended Learning Outcomes (ILOs) in the Bachelor in Chemistry Program, FMIPA, USK

| No | CODE | COURSE | ILO* | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | SKS | 01 | 02 | 03 | 04 | 05 | F02 | K02 | K03 | K05 | B02 | I05 | S01 | S03 | W01 | W02 | W03 | W05 | Total |
| **SEMESTER 1** | | | | | | | | | | | | | | | | | | | | | |
| 1 | MKWU1002 | Civic Education | 2 | 2 | | | | | | | | | | | | | | | | | 2 |
| 2 | MKWU1005 | Disaster Management And Environment | 2 | 2 | | | | | | | | | | | | | | | | | 2 |
| 3 | MKWU1006 | Character Building 1 | 0 | 0 | | | | | | | | | | | | | | | | | 0 |
| 4 | SMPA1001 | Introduction to Calculus | 3 | | 3 | | | | | | | | | | | | | | | | 3 |
| 5 | SMPA1003 | Introduction to Physics | 2 | | | | | | 2 | | | | | | | | | | | | 2 |
| 6 | SMPA1005 | Introduction to Chemistry | 2 | | | | | | | 0,4 | 0,4 | 1,2 | | | | | | | | | 2 |
| 7 | SMPA1007 | Introduction to Biology | 2 | | | | | | | | | | 2 | | | | | | | | 2 |
| 8 | SMPA1009 | Introduction to Industrial Revolution | 2 | | | | | | | | | | | 2 | | | | | | | 2 |
| 9 | SMPA1021 | Practicum of Introduction to Physics | 1 | 1 | | | | | | | | | | | | | | | | | 1 |
| 10 | SMPA1019 | Practicum of Introduction to Chemistry | 1 | | | 1 | | | | | | | | | | | | | | | 1 |
| 11 | SMPA1017 | Practicum of Introduction to Biology | 1 | | | | | | | | | | 1 | | | | | | | | 1 |
| 12 | SMKM1003 | Principle of Separation Methods | 2 | 0,5 | 0,5 | | 0,5 | 0,5 | | | | | | | | | | | | | 2 |
| **SEMESTER 2** | | | | | | | | | | | | | | | | | | | | | |
| 13 | MKWU1001 | Pancasila | 2 | 2 | | | | | | | | | | | | | | | | | 2 |
| 14 | MKWU1003 | Indonesian Language | 2 | 2 | | | | | | | | | | | | | | | | | 2 |
| 15 | MKWU1004 | English | 2 | 2 | | | | | | | | | | | | | | | | | 2 |
| 16 | MKWU1007 | Character Building 2 | 0 | 0 | | | | | | | | | | | | | | | | | 0 |
| 17 | SMPA1011 | Statistical Methods | 2 | | | | | | | | | | | | 1 | 1 | | | | | 2 |
| 18 | SMKM1002 | Basic Chemistry | 3 | | | | | 3 | | | | | | | | | | | | | 3 |
| 19 | SMKM1004 | Practicum of Basic Chemistry | 1 | | | 1 | | | | | | | | | | | | | | | 1 |
| 20 | SMKM1006 | Scientific | 2 | | | | | 2 | | | | | | | | | | | | | 2 |

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mathematics | | | | | | | | | | | | | | | | | | | | |
| 21 | SMKM1008 | Fundamental of Physics | 3 | | | | | 3 | | | | | | | | | | | | | | 3 |
| 22 | SMKM1010 | Laboratory Management | 2 | | | 2 | | | | | | | | | | | | | | | | 2 |
| **SEMESTER 3** | | | | | | | | | | | | | | | | | | | | | | |
| 23 | SMKM2005 | Physical Chemistry I | 3 | | | | | 3 | | | | | | | | | | | | | | 3 |
| 24 | SMKM2007 | Practicum of Physical Chemistry I | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 25 | SMKM2009 | Inorganic Chemistry I | 3 | | | | | 3 | | | | | | | | | | | | | | 3 |
| 26 | SMKM2011 | Analytical Chemistry I | 3 | 1,5 | | | | 1,5 | | | | | | | | | | | | | | 3 |
| 27 | SMKM2013 | Practicum of Analytical Chemistry I | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 28 | SMKM2015 | Organic Chemistry I | 3 | | 0,9 | | | 2,1 | | | | | | | | | | | | | | 3 |
| 29 | SMKM2017 | Practicum of Organic Chemistry I | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 30 | SMKM2019 | Biochemistry I | 3 | | | | | 3 | | | | | | | | | | | | | | 3 |
| 31 | SMKM2021 | Practicum of Biochemistry I | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 32 | MKWU2001 | Religion Education | 2 | 2 | | | | | | | | | | | | | | | | | | 2 |
| **SEMESTER 4** | | | | | | | | | | | | | | | | | | | | | | |
| 33 | SMKM2012 | Physical Chemistry II | 3 | | | | | 3 | | | | | | | | | | | | | | 3 |
| 34 | SMKM2014 | Practicum of Physical Chemistry II | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 35 | SMKM2016 | Inorganic Chemistry II | 3 | | | | | 3 | | | | | | | | | | | | | | 3 |
| 36 | SMKM2018 | Practicum of Inorganic Chemistry II | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 37 | SMKM2020 | Analytical Chemistry II | 3 | 1 | | | | 2 | | | | | | | | | | | | | | 3 |
| 38 | SMKM2022 | Practicum of Analytical Chemistry II | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 39 | SMKM2024 | Organic Chemistry II | 3 | | 0,9 | | | 2,1 | | | | | | | | | | | | | | 3 |
| 40 | SMKM2026 | Practicum of Organic Chemistry II | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |
| 41 | SMKM2028 | Biochemistry II | 3 | | | | | 3 | | | | | | | | | | | | | | 3 |
| 42 | SMKM2030 | Practicum of Biochemistry II | 1 | | | 1 | | | | | | | | | | | | | | | | 1 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SEMESTER 5** | | | | | | | | | | | | | | | | | | | | | |
| 43 | SMKM3023 | Physical Chemistry III | 3 | | | | | 3 | | | | | | | | | | | | | 3 |
| 44 | SMKM3025 | Inorganic Chemistry III | 3 | | | | | 3 | | | | | | | | | | | | | 3 |
| 45 | SMKM3027 | Practicum of Inorganic Chemistry III | 1 | | | 1 | | | | | | | | | | | | | | | 1 |
| 46 | SMKM3029 | Instrumentation Analysis | 3 | 0,9 | | | | 2,1 | | | | | | | | | | | | | 3 |
| 47 | SMKM3031 | Practicum of Instrumentation Analysis | 1 | 0,25 | 0,25 | 0,25 | | 0,25 | | | | | | | | | | | | | 1 |
| 48 | SMKM3033 | Organic Chemistry III | 3 | | 1,5 | | | 1,5 | | | | | | | | | | | | | 3 |
| 49 | SMKM3035 | Structure Elucidation of Organic Compounds | 3 | | | 1,2 | | 1,8 | | | | | | | | | | | | | 3 |
| 50 | SMKM3037 | Biochemistry III | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 51 | SMPA3013 | Entrepreneurship | 2 | | | | | | | | | | | | | | 0,5 | 0,5 | 0,5 | 0,5 | 2 |
| 52 | SMPA3015 | Practicum of Entrepreneurship | 1 | | | | | | | | | | | | | | 1 | | | | 1 |
| **SEMESTER 6** | | | | | | | | | | | | | | | | | | | | | |
| 53 | SMKM3032 | Physical Chemistry IV | 3 | | | | | 3 | | | | | | | | | | | | | 3 |
| 54 | SMKM3034 | Organometallics | 2 | | 1 | | | 1 | | | | | | | | | | | | | 2 |
| 55 | SMKM3036 | Organic Chemistry of Natural Product | 2 | 0,4 | 0,7 | | | 0,9 | | | | | | | | | | | | | 2 |
| 56 | SMKM3038 | Biochemistry Research Techniques | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 57 | SMKM3040 | Research Methodology | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 58 | SMKM3042 | Colloquium | 2 | | | | 1 | 1 | | | | | | | | | | | | | 2 |
| **SEMESTER 7** | | | | | | | | | | | | | | | | | | | | | |
| 59 | MKWUP001 | Community Service Program | 2 | 2 | | | | | | | | | | | | | | | | | 2 |
| 60 | SMPAP001 | Internship | 3 | | | | | 3 | | | | | | | | | | | | | 3 |
| 61 | SMPAP002 | Research Proposal | 2 | | | | 1 | 1 | | | | | | | | | | | | | 2 |
| **SEMESTER 8** | | | | | | | | | | | | | | | | | | | | | |
| 62 | SMPAPA01 | Final Project | 4 | 0,4 | 0,4 | 1,2 | 1,2 | 0,8 | | | | | | | | | | | | | 4 |
| **ELECTIVE COURSES OFFERED IN SEMESTER 7** | | | | | | | | | | | | | | | | | | | | | |
| 63 | SMKM6039 | Electrochemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 64 | SMKM6041 | Material Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 65 | SMKM6043 | Surface Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 66 | SMKM6045 | Petroleum Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 67 | SMKM6047 | Radiation Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 68 | SMKM6049 | Bioinorganic Chemistry | 2 | 0,5 | 0,5 | | | 1 | | | | | | | | | | | | | 2 |
| 69 | SMKM6051 | Catalysts | 2 | | | | 1 | 1 | | | | | | | | | | | | | 2 |
| 70 | SMKM6053 | Mineralogy | 2 | | 1 | | | 1 | | | | | | | | | | | | | 2 |
| 71 | SMKM6055 | Applied Analytical Chemistry | 2 | 0,4 | 0,5 | | 0,6 | 0,5 | | | | | | | | | | | | | 2 |
| 72 | SMKM6057 | Environmental Chemistry | 2 | 0,5 | 0,5 | | 0,5 | 0,5 | | | | | | | | | | | | | 2 |
| 73 | SMKM6059 | Chemical Analysis of Halal Products | 2 | 0,2 | | 0,6 | 0,8 | 0,4 | | | | | | | | | | | | | 2 |
| 74 | SMKM6061 | Introduction of Chromatography | 2 | | 0,75 | 0,75 | 0,5 | | | | | | | | | | | | | | 2 |
| 75 | SMKM6063 | Introduction to Organic Synthesis | 2 | | | 0,4 | | 1,6 | | | | | | | | | | | | | 2 |
| 76 | SMKM6065 | Basic Bioassay Technology | 2 | | | 1 | | 1 | | | | | | | | | | | | | 2 |
| 77 | SMKM6067 | Bioinformatics | 2 | | 0,2 | 1 | | 0,8 | | | | | | | | | | | | | 2 |
| 78 | SMKM6069 | Food Chemistry | 2 | | 0,5 | 0,5 | | 1 | | | | | | | | | | | | | 2 |
| 79 | SMKM6071 | Medicinal Chemistry | 2 | | 0,5 | 0,5 | | 1 | | | | | | | | | | | | | 2 |
| **ELECTIVE COURSES OFFERED IN SEMESTER 6** | | | | | | | | | | | | | | | | | | | | | |
| 80 | SMKM6044 | Solid State Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 81 | SMKM6046 | Industrial Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 82 | SMKM6048 | Polymer Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 83 | SMKM6050 | Chemistry of Colloid | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 84 | SMKM6052 | Computational Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 85 | SMKM6054 | Coordination Chemistry | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 86 | SMKM6056 | Capita Selecta in Inorganic Chemistry | 2 | | | | 1 | 1 | | | | | | | | | | | | | 2 |
| 87 | SMKM6058 | Inorganic Synthesis | 2 | | | | 1 | 1 | | | | | | | | | | | | | 2 |
| 88 | SMKM6060 | Sensors and Biosensors | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 89 | SMKM6062 | Chemometrics | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 90 | SMKM6064 | Advanced Separation Techniques | 2 | | 1 | | 1 | | | | | | | | | | | | | | 2 |

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 91 | SMKM6066 | Environmental Impact Assesment | 2 | | | | | 2 | | | | | | | | | | | | | 2 |
| 92 | SMKM6068 | Waste Treatment | 2 | | 1 | | 1 | | | | | | | | | | | | | | 2 |
| 93 | SMKM6070 | Organic Stereo Chemistry | 2 | | 2 | | | | | | | | | | | | | | | | 2 |
| 94 | SMKM6072 | Secondary Metabolite Analysis | 2 | | | 1,2 | | 0,8 | | | | | | | | | | | | | 2 |
| 95 | SMKM6074 | Microbiology | 2 | | | 1 | | 1 | | | | | | | | | | | | | 2 |
| 96 | SMKM6076 | Fermentation Technology | 2 | | 0,8 | | | 1,2 | | | | | | | | | | | | | 2 |
| 97 | SMKM6078 | Biotechnology | 2 | | | | 1,2 | 0,8 | | | | | | | | | | | | | 2 |
| 98 | SMKM6080 | Practicum of Environmental Impact Assessment | 1 | | | | | 1 | | | | | | | | | | | | | 1 |
| Total Weight of ILO Assessment Samples | | | 197 | 21,55 | 18,4 | 23,6 | 12,3 | 107,15 | 2 | 0,4 | 0,4 | 1,2 | 3 | 2 | 1 | 1 | 1,5 | 0,5 | 0,5 | 0,5 | 197 |
| Percentage Weight of ILO Assessment Samples | | | | 10,9 % | 9,3 % | 12,0 % | 6,2 % | 54,3% | 1 % | 0,2 % | 0,2 % | 0,6 % | 1,5 % | 1 % | 0,5 % | 0,5 % | 0,8 % | 0,3 % | 0,3 % | 0,3 % | 100% |

*Note: This table reflects the proportional contribution of selected course assessments to the overall intended earning outcomes (ILO). The data is derived from a representative sample and used for evaluation and monitoring purposes.*

Key Focus Points for Measuring ILO Achievement:

1. A single ILO may be achieved through multiple CPMKs distributed across more than one course.
2. CLO should remain consistent even if the course title changes.
3. Each ILO should ideally be linked to no more than four courses to ensure ease of calculation.
4. The number of CPMK (CLOs) per course should not exceed five, although they may be further elaborated through sub-CLO.
5. The achievement of CPMK (CLOs) within a course must be reflected comprehensively across all forms of assessment in that course.
6. A minimum score of above 50 may be considered as having met the expected CPMK (CLOs)performance.

**Example of Student ILO Scores**

Each student's performance is calculated based on the achievement of ILOs embedded within the relevant courses. The example below illustrates how a student's academic performance can be associated with specific ILO achievements.

**NAME : Dilnoza Abdunazarova**
**STUDENT ID.: 2108103010071**

| Sem | No | Code | Course | ILO01 | ILO02 | ILO03 | ILO04 | ILO05 |
|---|---|---|---|---|---|---|---|---|
| I | 1 | SMPA1005 | Introduction to Chemistry | | 75 | 85 | | 87,5 |
| II | 2 | SMKM1002 | Basic Chemistry | | 70 | 79,5 | | 85 |
| | 3 | SMKM1006 | Scientific Mathematics | | | | | 80 |
| III | 4 | SMKM2015 | Organic Chemistry I | | 67,25 | | | 78 |
| IV | 5 | SMKM2015 | Biochemistry II | | | | | 70 |
| V | 6 | SMKM3029 | Instrumentation Analysis | 70 | | | | 80 |
| VI | 7 | SMKM3036 | Organic Chemistry of Natural Product | 75 | 72,5 | | | 80 |
| | 8 | SMKM3034 | Organometallics | 88 | 77,5 | | | 88 |
| | 9 | SMKM3038 | Biochemistry Research Techniques | | | 70 | | 75 |
| | 10 | SMKM3042 | Colloquium | | | | 92,5 | 89 |
| VII | 11 | MKWUP001 | Community Service Program | 90 | 85 | | | |
| | 12 | SMPAP002 | Research Proposal | | | | 90 | 88 |
| VIII | 13 | SMPAPA01 | Final Project | 79 | 88 | 83 | 87 | 80 |
| ILO Score | | | | 80,4 | 76,5 | 79,4 | 89,8 | 81,7 |

***Note:*** *ILO scores are calculated based on the proportional weight of each course's ILO contribution to the total ILO weight.*

**ILO Transcript of Students in the Bachelor in Chemistry Program(SMKM), FMIPA USK:**

KEMENTERIAN PENDIDIKAN TINGGI, SAINS, DAN TEKNOLOGI
UNIVERSITAS SYIAH KUALA
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
**PROGRAM STUDI MAGISTER KIMIA**
Jln. Syekh Abdurrauf No. 3, Darussalam, Banda Aceh 23111, Gedung B Lt. 2
Laman: https://mkim.fmipa.usk.ac.id/ Surel: magisterkimia@fmipa.usk.ac.id

Intended Learning Outcome (ILO)-Based Academic Transcript

Name : Dilnoza Abdunazarova
Student ID : 2108103010071
Place of Birth : Dushanbe, Tajikistan
Date of Birth : 07 November 2004

Faculty : MIPA
Program : Bachelor in Chemistry Program
Education Level : Bachelor
Graduation Date : 2024

| NO | Code | Program Learning Outcome (ILO) | Score | Category |
|---|---|---|---|---|
| 1 | ILO01 | To cultivate a sense of piety, ethical conduct, integrity, social consciousness and a commitment to lifelong learning. | 80,4 | Distinction |
| 2 | ILO02 | To effectively communicate, solve problems, collaborate within diverse environments, and comprehend the commercialization of chemical knowledge and skills. | 76,5 | Distinction |
| 3 | ILO03 | To conduct chemical experiments independently and responsibly, as well as to manage, analyze, and interpret the resulting data. | 79,4 | Distinction |
| 4 | ILO04 | To effectively conduct and report the findings of chemistry research in accordance with established scientific standards, while remaining adaptable to technological advancements. | 89,8 | Excellent |
| 5 | ILO05 | To understand foundational concepts in chemistry, mathematics, and other natural sciences, and to proficiently apply this integrated knowledge to resolve everyday challenges. | 81,7 | Distinction |

Grading Scale: 81 – 100 : Excellent
61 – 80 : Good
51 – 60 : Fair
<51 : Poor

Banda Aceh, February 21, 2024
Chairperson,

Dr. Khairi, M.Si
NIP. 196906141999031002

To ensure that every graduate of the Bachelor in Chemistry Program at Universitas Syiah Kuala (USK) has fulfilled all the expected Intended Learning Outcomes (ILO), the following measures are implemented:

1. The Study Program establishes minimum ILO graduation standards, target levels for ILO achievement, and ILO graduation predicates (Excellent, Good, Fair, and Poor).
2. The Study Program monitors students' ILO attainment at the end of each academic year and provides recommendations to those who have not yet met the targeted achievement levels.
3. The Study Program issues a ILO Transcript in addition to the Academic Transcript for all graduates at the time of Official graduation approval (*Yudisium*).

### 4.3 Monitoring of Learning Implementation and Evaluation of Course Learning Outcomes (CLO) Achievement

The monitoring of learning implementation and the evaluation of CPMK achievement are conducted as part of the quality assurance cycle, namely: Determination, Implementation, Evaluation, Control, and Improvement (Ind: PPEPP), to ensure the realization of continuous improvement. This monitoring focuses on learning content, learning processes, assessment methods, and lecturers' attendance. The evaluation of CLO achievement emphasizes the pass rate for each CLO, as well as the highest, lowest, and average scores of students.

Monitoring and evaluation activities are carried out as follows:

1. Each lecturer is required to prepare a course control plan at the beginning of the semester.
2. Each lecturer must record student attendance during each class meeting and complete a weekly teaching implementation monitoring sheet.
3. Each course must consist of 16 sessions per semester, including the Midterm Examination (Ind: UTS) and the Final Examination (Ind: UAS).
4. At the end of each semester, students are required to evaluate the performance of lecturers by completing an online learning process questionnaire.
5. At the end of each semester, lecturers must evaluate the teaching process and the achievement of learning outcomes by completing a portfolio provided by the Study Program. The results must be submitted to the Study Program for further evaluation.
6. The Study Program Coordinator evaluates lecturer attendance, the consistency between the semester lesson plan (Ind: RPS) and its implementation, and the punctuality of final grade submission.

Below is an example of the evaluation and analysis of CLO (Ind: CPMK) achievement used as a reference by the Bachelor in Chemistry Program(SMKM) at USK.

**Evaluation of CPMK Achievement:**

| Students' Initials | Assessment Items | | | | | | | | CPMK Weights | | | | ILO Weights | | | Final Grade | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Assign. 1 | Assign. 2 | Quiz 1 | Quiz 2 | UTS | | UAS | | ILO-01 | ILO-02 | | ILO-03 | ILO-01 | ILO-02 | ILO-03 | | |
| | CPMK1 | CPMK2 | CPMK3 | CMPK4 | CPMK1 | CPMK2 | CPMK3 | CPMK4 | CPMK1 | CPMK2 | CPMK3 | CPMK4 | | | | Numeric | Letter |
| | 10% | 10% | 15% | 15% | 15% | 10% | 10% | 15% | 25.0% | 20.0% | 25.0% | 30.0% | 25% | 45% | 30% | 100% | |
| A | 100 | 90 | 80 | 70 | 80 | 90 | 85 | 85 | 88.00 | 90 | 82 | 77.5 | 88.00 | 85.56 | 77.5 | 84 | AB |
| B | 90 | 80 | 75 | 80 | 75 | 70 | 75 | 60 | 81.00 | 75 | 75 | 70 | 81.00 | 75.00 | 70 | 75 | B |
| C | 50 | 60 | 75 | 80 | 45 | 45 | 70 | 55 | 47.00 | 52.5 | 73 | 67.5 | 47.00 | 63.89 | 67.5 | 61 | BC |
| D | 89 | 56 | 45 | 60 | 60 | 70 | 80 | 70 | 71.60 | 63 | 59 | 65 | 71.60 | 60.78 | 65 | 65 | BC |
| E | 75 | 60 | 75 | 45 | 70 | 80 | 55 | 40 | 72.00 | 70 | 67 | 42.5 | 72.00 | 68.33 | 42.5 | 62 | BC |
| F | 80 | 60 | 75 | 90 | 70 | 80 | 60 | 60 | 74.00 | 70 | 69 | 75 | 74.00 | 69.44 | 75 | 72 | B |
| rata | 80.7 | 67.7 | 70.8 | 70.8 | 66.7 | 72.5 | 70.8 | 61.7 | 72.3 | 70.1 | 70.8 | 66.3 | 72.3 | 70.5 | 66.3 | 69.7 | B |

Terminology notes:

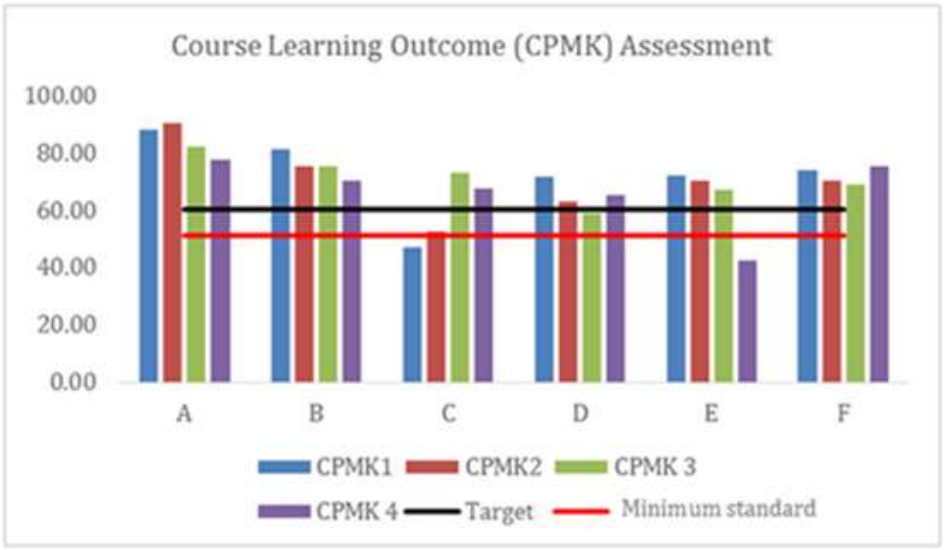
Assign. = Assignment

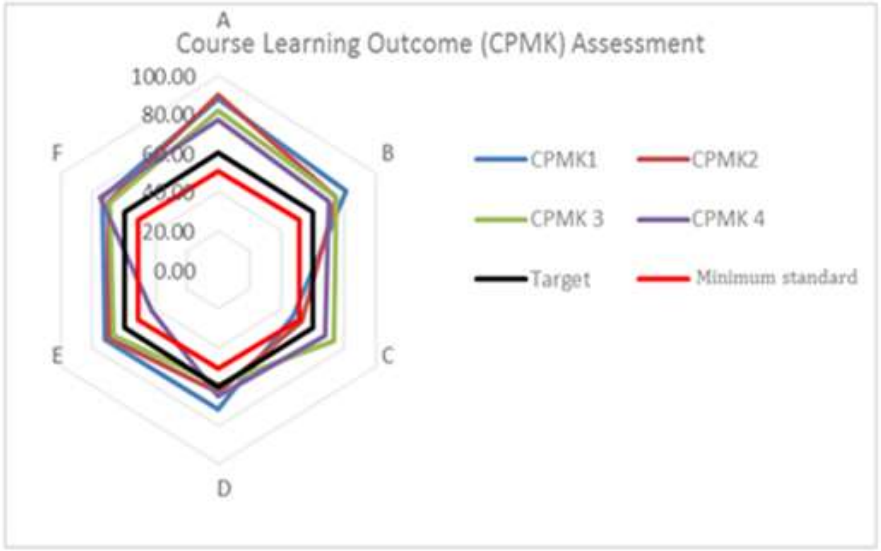
UTS = Midterm Examination

UAS = Final Examination

CPMK = Course Learning Outcomes

ILO = Intended Learning Outcomes


Course Learning Outcome (CPMK) Assessment
100.00
80.00
60.00
40.00
20.00
0.00
A
B
C
D
E
F
CPMK1
CPMK2
CPMK 3
CPMK 4
Target
Minimum standard


A
Course Learning Outcome (CPMK) Assessment
100.00
80.00
20.00
0.00
B
C
D
E
F
CPMK1
CPMK2
CPMK 3
CPMK 4
Target
Minimum standard

Analysis of Course Learning Outcomes (CLO) Achievement:

- The minimum passing score for each CLO in a course is set at 51, corresponding to a letter grade of C on a 100-point scale. This indicates that the minimum expected level of student comprehension for each learning outcome is 51%. The course instructor sets a target average score of 60 (letter grade BC), reflecting 60% comprehension of the intended learning outcomes.
- The average CPMK scores for all students exceeded the target value of 60. However, two students (approximately 33.33% of a total of six students) did not meet the minimum CPMK score for CPMK 1 and CPMK 4, as shown in the CPMK assessment table.
- The average ILO (ILO) score across all students also exceeded 60. However, two students had ILO scores below the passing threshold, specifically in ILO A and ILO F, as indicated in the ILO assessment table.
- The final course grade average for all students was 69.7, which corresponds to a letter grade of B (69.7)

Corrective Actions Taken

Based on the learning outcome achievements, further evaluation was conducted to understand the factors contributing to students' performance. A specific observation was carried out on the two students who did not meet the minimum target scores for certain CPMK. The observation revealed that both students obtained low scores in their midterm (UTS) and final examinations (UAS). The course coordinator also confirmed their attendance records during the course sessions. The main challenge faced by these students was their lack of preparedness for examinations that involved design and calculation-based problems related to the course content. As a result, they were unable to complete exam questions effectively.

Planned Corrective Actions

To address cases in which students fail to meet specific ILO (ILO) targets, the Study Program will implement strategic remedial actions. These may include supplementary lectures followed by reassessment of the relevant CLO (CPMK), retaking exams, or completing additional assignments.

The assessment and evaluation of ILO achievement is conducted by the Study Program at the end of each academic year. This process is intended to monitor and evaluate ILO attainment for each student cohort and serves as a basis for continuous improvement in the learning process within the Bachelor in Chemistry Program.

## APPENDICES

Appendix 1. List of Academic Staffs – Bachelor in Chemistry Program, FMIPA, USK

| No | Academic Staff Name | Employee ID (NIP) | Place of Birth | Date of Birth | Rank/ Grade (Civil Service) | Academic Position |
|---|---|---|---|---|---|---|
| 1 | Prof. Dr. Ir. Rosnani Nasution, S. Si., M. Si. | 195712241991022000 | Pematang Siantar | 24/12/1957 | IV/d | Professor |
| 2 | Prof. Dr. rer. nat. Ir. Rinaldi Idroes, S. Si. | 196808251994031000 | Sigli | 25/08/1968 | IV/e | Professor |
| 3 | Prof. Dr. Eka Safitri, S. Si., M. Si. | 197001052000032000 | Banda Aceh | 05/01/1970 | IV/c | Professor |
| 4 | Prof. Dr. Rahmi, S. Si., M. Si. | 197209271999032000 | Baso | 27/09/1972 | IV/c | Professor |
| 5 | Prof. Dr. Binawati Ginting, S. Si., M. Si. | 197209271999032000 | Lubuk Pakam | 27/09/1972 | IV/b | Professor |
| 6 | Prof. Dr. Febriani S. Si, M. Si | 197202171999032000 | Maninjau | 17/02/1972 | IV/b | Professor |
| 7 | Prof. Dr. Muliadi Ramli, S. Si., M. Si | 197303011998021000 | Lamgugob, Aceh Besar | 01/03/1973 | IV/b | Professor |
| 8 | Dr. Khairi S. Si., M. Si. | 196906141999031000 | Bah Butong | 14/06/1969 | IV/b | Associate Professor |
| 9 | Dr. Lelifajri, S. Si, M. Si. | 197002212000032000 | Banda Aceh | 21/02/1970 | III/d | Associate Professor |
| 10 | Dr. Nurhaida, S. Si., M. Si. | 197003301999032000 | Banda Aceh | 30/03/1970 | IV/c | Associate Professor |
| 11 | Dr. Julinawati S.Si., M.Si | 197107011997022000 | Cot Ie Ju | 01/07/1971 | IV/a | Associate Professor |
| 12 | Muhammad Bahi, S. Si., M. Sc., Ph. D. | 197209281997021000 | Banda Aceh | 28/09/1972 | IV/b | Associate Professor |
| 13 | Dr. Nazaruddin, S. Si, M. Si. | 197006211997031000 | Blangkire | 21/06/1970 | III/c | Assistant Professor |
| 14 | Dr. Elly Sufriadi, S. Si., M. Si. | 197103302000121000 | Aceh Selatan | 30/03/1971 | III/d | Assistant Professor |
| 15 | Sitti Saleha, S. Si., M. Si | 197009281995122000 | Medan | 28/09/1970 | IV/a | Associate Professor |
| 16 | Irfan Mustafa, S. Si., M. Si. | 197411302002121000 | Banda Aceh | 30/11/1974 | III/d | Assistant Professor |
| 17 | Sheilatina, S. Si., M. Sc. | 197808052003122000 | Lhokseumawe | 05/08/1978 | III/c | Assistant Professor |
| 18 | Fathurahmi, S. Si., M. Si. | 197811042008121000 | Perapat, Aceh Tenggara | 04/11/1978 | III/c | Assistant Professor |

| | | | | | | |
|---|---|---|---|---|---|---|
| 19 | Kartika MZ, S. Si., M. Si. | 199401212022032000 | Agam | 21/01/1994 | III/b | Lecturer |
| 20 | Ruhul Maghfirah, S. Si., M. Si. | 199509252024062001 | Banda Aceh | 25/09/1995 | III/b | Lecturer |
| 21 | Mutia Farida, S. Pd. I., M. Si. | 199101092024062001 | Paya Rangkuluh | 09/01/1991 | III/b | Lecturer |
| 22 | Muhammad Ridho Afifi, S. Si., M. Si. | 198911182024061001 | Palembang | 18/11/1989 | III/b | Lecturer |
| 23 | Agnia Purnama, S. Si., M. Si. | 199701292024062002 | Aceh Tengah | 29/01/1997 | III/b | Lecturer |

Appendix 2. Subject matter in Bachelor in Chemistry Program

| No | Code | CORE SUBJECT AREA | SUBTOPICS |
|---|---|---|---|
| 1 | BK01 | Terminology and chemical nomenclature, conventions and units | 1. Chemical symbols, units in chemical calculations, stoichiometry of chemical reactions<br>2. Terminology and nomenclature of chemical and biomolecular compounds |
| 2 | BK02 | Properties of elements and their compounds, including group trends and periodic table relationships | 1. Atomic structure and characteristics<br>2. Periodic properties of elements<br>3. Characteristics and reactivity of elements<br>4. Introduction to compound formation from elements |
| 3 | BK03 | Characteristics of the states of matter and theoretical frameworks for their description | 1. Phase equilibrium concepts<br>2. Acid–base concepts<br>3. Inter- and intramolecular forces |
| 4 | BK04 | Types and characteristics of chemical reactions | 1. Types and characteristics of chemical reactions:<br>● Acid–base<br>● Association, dissociation, insertion<br>● Stepwise, chain, and complex reactions<br>● Photochemical reactions<br>● Condensation and rearrangement<br>● Polymerization<br>● Redox and precipitation<br>● Substitution, elimination, addition, esterification<br>● Chemical reactions in biological systems<br>2. Reaction thermodynamics (exothermic, endothermic)<br>3. Reaction equilibrium |
| 5 | BK05 | Principles and procedures in chemical analysis and compound characterization | 1. Principles and procedures of qualitative and quantitative analysis<br>2. Principles, procedures, characterization and interpretation of chemical compounds<br>3. Principles, procedures, characterization and interpretation of biomolecules<br>4. Analytical and characterization techniques: thermal analysis (DTG/TGA, DSC, AAS), spectrophotometry (IR, UV-Vis), chromatography (HPLC, GC, FPLC), PSA, XRD, XRF, SEM-EDX, TEM, BET, electrometric (potentiometry, voltammetry, conductometry, EIS), electrophoresis, sequencing,, PCR |
| 6 | BK06 | Principles of quantum mechanics and their application in explaining atomic and molecular structures and properties | 1. Principles of quantum mechanics<br>2. Fundamentals of electromagnetic radiation and light absorption for modeling simple and complex molecules<br>3. Applications of quantum mechanics to |

| | | | |
|---|---|---|---|
| | | | explain:<br>● Atomic and molecular structures and properties<br>● Chemical bonding<br>● Atomic and molecular spectra<br>● Electromagnetic radiation and light absorption |
| 7 | BK07 | Thermodynamic principles and their applications in chemistry | 1. Laws of thermodynamics<br>2. Thermodynamic principles<br>3. Applications in chemical reactions, bioenergetics, and metabolic pathways |
| 8 | BK08 | Chemical kinetics, including catalysis and its interpretation in chemical reactions | 1. Reaction kinetics, mechanisms, and stability<br>2. Catalysis and photo-catalysis in compound synthesis<br>3. Enzymatic catalysis |
| 9 | BK09 | Key techniques for structure determination using spectroscopy | 1. Basic principles of spectroscopy<br>2. Procedures in selected spectroscopic techniques<br>3. Structure interpretation based on spectroscopic data<br>4. Structural analysis using IR, UV, NMR, MS, XRF, and XRD |
| 10 | BK10 | Properties of aliphatic, aromatic, heterocyclic, and organometallic compounds | Properties of aliphatic, aromatic, heterocyclic, and organometallic compounds |
| 11 | BK11 | Functional group properties and behaviors in organic molecules | Properties and behaviors of functional groups in organic and biomolecular compounds, including stereochemistry |
| 12 | BK12 | Synthesis/biosynthesis of organic, inorganic, and biomolecular compounds | 1. Techniques for isolation, synthesis, and biosynthesis of secondary metabolites, and their bioactivity testing<br>2. Synthesis of inorganic compounds, including organometallics, and their bioactivity testing<br>3. Fundamental principles and regulation of biosynthetic pathways and metabolic energy use |
| 13 | BK13 | Relationship between macromolecular properties and their constituent atoms/molecules, including biomolecules, polymers, and other materials | 1. Structure and function of polymers (inorganic, organic, and biomolecular)<br>2. Correlation between the properties of monomers and polymers (inorganic, organic, and biomolecular) |
| 14 | BK14 | Structure and reactivity of key biomolecules and chemical aspects of biological processes | Structure, function, and metabolism of biomolecules |
| 15 | BK15 | Utilization and management of | Special topics on the application of green |

| | | | |
|---|---|---|---|
| | | local natural resources | chemistry and blue chemistry in the fields of:<br>1. Food<br>2. Energy<br>3. Health<br>4. Global climate change |
| 16 | BK16 | Laboratory safety and data management | 1. Occupational safety, chemical and equipment handling<br>2. Chemical big data and its applications<br>3. Ethics in artificial intelligence usage and plagiarism prevention |
| 17 | BK17 | Religious, national, and civic character values | 1. Religious values, Pancasila, and citizenship<br>2. Language and culture, as well as character education related to disaster and environmental awareness |

Appendix 3. Elective courses under the MBKM Program

| MBKM Program | Recognized Compulsory Courses | | | Additional Elective Courses Offered | | | Remarks |
|---|---|---|---|---|---|---|---|
| | Course Name | Code | Credits (sks) | Course Name | Code | Credits (sks) | |
| Student Exchange | | | | | | | Conversion is made from courses with equivalent CPMKs in the curriculum |
| Entrepreneurship | Entrepreneurship | SMPA 3101 | 2 (2 - 0) | Entrepreneurial Practice | SMPA 6301 | 17 (0 - 17) | Conducted over 6 months |
| | Practicum of Entrepreneurship | SMPA 3201 | 1 (0-1) | | | | |
| Research | Research Proposal | SMPA 4301 | 2 (0 - 2) | Scientific Publication | SMPA 6302 | 11 (0 - 11) | Research must be conducted outside USK for a minimum of one semester. Scientific Publication course is not recognized without a valid output |
| | Final Project | SMPA 4400 | 4 (0 - 4) | | | | |
| | Internship | SMPA 4302 | 3 (0 - 3) | | | | |
| Internship | Internship | SMPA 4302 | 3 (0 - 3) | Industrial Internship A | SMPA 6303 | 17 (0 - 17) | Duration: 5–6 months |
| | | | | Industrial Internship B | SMPA 6304 | 11 (0 - 11) | Duration: 3–4 months |
| Village Development Project | Community Service Program | MKWU P001 | 2 (0 - 2) | Village Project A | SMPA 6305 | 18 (0 - 18) | Duration: 5–6 months |
| | | | | Village Project B | SMPA 6306 | 12 (0 - 12) | Duration: 3–4 months |
| Teaching Practice in School | Community Service Program | MKWU P001 | 2 (0 - 2) | Science Teaching Practice A | SMPA 6307 | 18 (0 - 18) | Duration: 5–6 months |
| | | | | Science Teaching Practice B | SMPA 6308 | 12 (0 - 12) | Duration: 3–4 months |
| Humanitarian Service Program | | | | | | | To be offered in the upcoming semester |
| Independent Study/ Project | | | | | | | Conversion is made from courses with equivalent CPMKs in the curriculum and may be combined with other MBKM Elective Courses |

*Note: Course codes for MBKM Elective Courses in Diploma Programs should be adjusted according to the codification guidelines described in the curriculum manual*