

UNIVERSITAS NEGERI MANADO



MODULE HANDBOOK

Bachelor of Chemistry

UNIVERSITAS NEGERI MANADO
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
JURUSAN KIMIA
PROGRAM STUDI KEPENDIDIKAN DAN NON KEPENDIDIKAN

2026

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Module Description Bachelor of Chemistry

No	Code	Module	Total Credits	Total Cumulative
1	30112101	Religious Education	2	20
2	30112102	Pancasila Education	2	
3	30112103	Civics Education	2	
4	30122104	Mathematics for Chemistry	2	
5	30122105	Physics for Chemistry	2	
6	30122106	Biology for Chemistry	2	
7	30136107	Basic Chemistry	6	
8	30132108	Basic Chemistry Practicum	2	
Total Credits 1st Semester			20	

No	Code	Module	Total Credits	Total Cumulative
1	30112209	Indonesian Language	2	40
2	30132221	Philosophy of Science and Mathematics (MIPA)	2	
3	30131212	Monofunctional Organic Chemistry Practicum	1	
4	30133213	Monofunctional Organic Chemistry	3	
5	30131214	Inorganic Non-Metal Chemistry Practicum	1	
6	30133215	Inorganic Non-Metal Chemistry	3	
7	30131316	Physical Chemistry Practicum	1	
8	30133317	Physical Chemistry	3	
9	30131218	Analytical Chemistry Practicum	1	
10	30133219	Fundamentals of Analytical Chemistry	3	
Total Credits 2nd Semester			20	

No	Code	Module	Jumlah	Total Cumulative
1	30133433	Chemical Structure and bonding	3	62
2	30121322	Polyfunctional Organic Chemistry Practicum	1	
3	30123323	Polyfunctional Organic Chemistry	3	
4	30131324	Inorganic Metal Chemistry Practicum	1	
5	30133325	Inorganic Metal Chemistry	3	
6	30131326	Chemical Kinetics Practicum	1	
7	30133327	Chemical Kinetics	3	
8	30131328	Chemical Separation Practicum	1	
9	30133329	Chemical Separation	3	
10	30131330	Practicum on Structure and Function of Biomolecules	1	
11	30133331	Structure and Function of Biomolecules	2	
Total Credits 3rd Semester			22	

No	Code	Module	Jumlah	Total Cumulative
1	30112210	English for Chemistry	2	84
2	30122332	Statistics Methods	3	
3	30133434	Reactivity and Mechanism of Organic Reactions	3	
4	30133435	Inorganic Physical Chemistry	3	
5	30131436	Chemical Thermodynamics Practicum	1	
6	30133437	Chemical Thermodynamics	3	
7	30131438	Instrumental Analysis Practicum	1	
8	30133439	Instrumental Analysis	3	
9	30131440	Metabolism and Genetic Information Practicum	1	
10	30133441	Metabolism and Genetic Information	2	
Total Credits 4th Semester			22	

No	Code	Module	Jumlah	Total Cumulative
1	30132651	Green Chemistry	2	106
2	30133543	Chemical Research Methodology	3	
3	30133544	Polymer Chemistry	3	
4	30133545	Natural Product Chemistry	3	
5	30133546	Structure Elucidation	3	
6	30133547	Organic Synthesis	3	
7	30133548	Advanced Analytical Chemistry	3	
8	30133542	Laboratory Management Techniques	2	
Total Credits 5th Semester			22	

No	Code	Module	Jumlah	Total Cumulative
1	30132650	Environmental Impact Assessment Chemistry	2	126
2	30132652	Food Chemistry	2	
3	30132653	Stereochemistry	2	
4	30132654	Medicinal Chemistry	2	
5	30132655	Chromatography	2	
6	30132656	Computational Chemistry	2	
7	30112211	Entrepreneurship	2	
8	30112420	Mapalus In Global Perspective	2	
9		ELECTIVE COURSES	4	
Total Credits 6th Semester			20	

No	Code	Module	Jumlah	Total Cumulative
1	30134757	Internship	4	138
2	30134649	Community Service Program	4	
3		ELECTIVE COURSES	4	
Total Credits 7th Semester			12	

No	Code	Module	Jumlah	Total Cumulative
1	30136893	Thesis	6	144
Total Credits 8th Semester			6	

Module Handbook

Bachelor of Chemistry

1st Semester

Bachelor of Chemistry
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Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Basic Chemistry
Module level	Bachelor/Undergraduate
Code	30136107
Semester(s) in which the module is taught	1 st semester
Person responsible for the module	<i>Dr. Rymond Rumampuk, M.Si</i>
Lecturer	<i>Dr. Rymond Rumampuk, M.Si Abdon Saiya, M.Si Stefan Rumengan, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Flipped classroom, problem-based learning, discussions, LMS-assisted learning (UNIMA LMS), group tasks, presentations, and structured exercises.</i>
Workload	<i>45 hours x 6 credit points = 270 hours per semester</i>
Credit points	<i>6 credits</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p><i>Students are able to:</i></p> <ul style="list-style-type: none"> • <i>Demonstrate responsibility, discipline, and independence in learning chemistry.</i> • <i>Understand atomic structure and periodic system of elements.</i> • <i>Determine chemical bonding types and predict physical/chemical properties.</i> <ul style="list-style-type: none"> • <i>Apply laws of chemistry in stoichiometric calculations.</i> • <i>Apply concepts of thermodynamics to predict reaction</i>

	<p>spontaneity.</p> <ul style="list-style-type: none"> Analyse and interpret chemical equilibrium behaviour.
Content	<p>1. Atomic Structure & Periodic System</p> <ul style="list-style-type: none"> Atomic models (Thomson, Rutherford, Bohr, Quantum) Subatomic particles, isotopes, isobars, isotones Electron configuration & quantum numbers Periodic properties of elements <p>2. Chemical Bonding & Molecular Structure</p> <ul style="list-style-type: none"> Lewis structures Ionic & covalent bonding VSEPR geometry & hybridization Resonance, polarity, molecular orbital theory (MOT) Intermolecular forces <p>3. Stoichiometry</p> <ul style="list-style-type: none"> Relative mass & molar mass Empirical & molecular formulas Chemical equations and balancing Limiting reagents Reaction yield Aqueous reactions (acid-base, redox, precipitation) <p>4. Chemical Thermodynamics</p> <ul style="list-style-type: none"> System, surroundings, work, heat First Law of Thermodynamics Enthalpy, entropy, Gibbs free energy Reaction spontaneity <p>5. Chemical Equilibrium</p> <ul style="list-style-type: none"> Equilibrium concept Equilibrium constants (K_c, K_p) Le Chatelier's Principle Temperature and equilibrium behavior
Examination forms	<p>Quizzes, written exams (midterm & final), laboratory reports, practical performance, analytical tasks, presentations, case analysis, observation-based evaluation.</p>
Study and examination requirements	<ul style="list-style-type: none"> Minimum attendance 75% Active participation in class, group discussions, and laboratory work Completion of individual and group assignments Mid-semester and final examinations Continuous assessment of laboratory performance, reports, and discussions

Reading list	<p><i>Main References:</i></p> <ol style="list-style-type: none">1. Chang, R. (2010). <i>Chemistry, 10th Ed.</i>, McGraw-Hill.2. Jespersen, N.D., Brady, J., & Hyslop, A. (2012). <i>Chemistry</i>. Wiley. <p><i>Supporting References:</i></p> <ul style="list-style-type: none">• Lecture notes and additional materials provided by lecturers.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Biology for Chemistry
Module level	Bachelor/Undergraduate
Code	30122106
Semester(s) in which the module is taught	1st Semester
Person responsible for the module	<i>Prof. Mokusuli Yermia Samuel, M.Si</i>
Lecturer	<i>Prof. Mokusuli Yermia Samuel, M.Si; Dr. Anderson Aloanis, M.Si.</i>
Language	<i>English / Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program supporting interdisciplinary competence between biology and chemistry.</i>
Teaching methods	<i>Lectures, discussions, small group discussions, discovery learning, contextual learning, project-based learning, and laboratory practices.</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>
Module objectives/intended learning outcomes	<p>After completing this module, students are expected to:</p> <p>Knowledge: <i>Understand fundamental biological concepts, including molecular chemistry of life, cell structure and function, genetics, evolution, biodiversity, and ecology.</i></p> <p>Skills: <i>Analyze biological phenomena and relationships between chemistry and biological processes through</i></p>

	<p>scientific reasoning and laboratory work.</p> <p>Competences: Apply scientific methods, critical thinking, and interdisciplinary approaches to explain and solve biological problems related to chemistry and environmental sustainability.</p>
Content	<ol style="list-style-type: none"> 1. Chemistry of life and biomolecules. 2. Cell structure and function. 3. Principles of genetics and inheritance. 4. Mechanisms and evidence of evolution. 5. Evolutionary history and biodiversity. 6. Plant anatomy, physiology, and tissue structure. 7. Animal anatomy, physiology, and tissue structure. 8. Photosynthesis and cellular respiration. 9. Ecology: biotic and abiotic components, ecosystems, biogeochemical cycles, and environmental interactions. 10. Biotechnology and applications in health, food, agriculture, and environment.
Examination forms	<p>Written tests, quizzes, oral presentations, laboratory reports, participation, and project-based assessments.</p>
Study and examination requirements	<ul style="list-style-type: none"> - Minimum attendance 75% - Active participation in class, group discussions, and laboratory work - Completion of individual and group assignments - Mid-semester and final examinations - Continuous assessment of laboratory performance, reports, and discussions
Reading list	<p>Main References:</p> <ul style="list-style-type: none"> • Urry, L.A., Cain, M.L., Wasserman, S.A., Minorsky, P.V., & Orr, R.B. (2021). <i>Campbell Biology</i> (12th ed.). Pearson. <p>Supporting References:</p> <ul style="list-style-type: none"> • Osellame, L.D., Blacker, T.S., & Duchon, M.R. (2012). Cellular and molecular mechanisms of mitochondrial function. <i>Best Practices & Research Clinical Endocrinology & Metabolism</i>, 26(6), 711-723. • Fan, Y., Sanyal, S., & Bruzzone, R. (2018). Breaking Bad: How Viruses Subvert the Cell Cycle. <i>Frontiers in Cellular and Infection Microbiology</i>, 8:396. • Sprunck, S. (2020). Gamete Interactions in Flowering Plants. <i>Current Opinion in Plant Biology</i>, 53, 106-116. • Shereen, M.A. et al. (2020). COVID-19 Infection: Origin, Transmission, and Characteristics of Human Coronaviruses. <i>Journal of Advanced Research</i>, 24, 91-98.

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| | <ul style="list-style-type: none">• Rudall, P.J. (2021). <i>Evolution and Patterning of the Ovule in Seed Plants</i>. <i>Biological Reviews</i>, 96, 943-960.• Nelson, M. (2018). <i>Some Ecological and Human Lessons of the Biosphere 2</i>. <i>European Journal of Ecology</i>, 4(1), 50-55.• Smith, G.P. (2014). <i>Introduction to the Immune Response. The Variation and Adaptive Expression of Antibodies</i>. Harvard University Press. |
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Bachelor of Chemistry

MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Buddhist Religious Education
Module level	Bachelor/Undergraduate
Code,	30112101
Semester(s) in which the module is taught	1 st semester
Person responsible for the module	Dr. IDK Anom
Lecturer	Dr. IDK Anom
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Interactive Lectures, Group Discussion, Case Study, Question & Answer, Project-Based Learning, Reflection, Meditation Practice</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>

<p>Module objectives/intended learning outcomes</p>	<p>Knowledge:</p> <ul style="list-style-type: none"> • Understand the history of Buddhism and the life of Gotama Buddha. • Explain fundamental Buddhist teachings (Four Noble Truths, Eightfold Path, Tilakkhana, Patikkasamuppada, Kamma). • Explain concepts of Divinity in Buddhism and the Three Jewels (Triratna). <p>Skills:</p> <ul style="list-style-type: none"> • Analyze moral and ethical concepts (Sila, Buddhist Pancasila). • Demonstrate understanding of meditation (Samadhi) and wisdom (Pañña). • Interpret Buddhist teachings for contemporary societal issues. <p>Competences:</p> <ul style="list-style-type: none"> • Apply Buddhist values in personal and social life. • Exhibit tolerance, harmony, and ethical behavior in a pluralistic society. • Contribute to nation-building using Dhamma-based perspectives.
<p>Content</p>	<ol style="list-style-type: none"> 1. Introduction: Religion and national character formation 2. Life of Gotama Buddha 3. Concept of Divinity (YME) in Buddhism and the Triratna 4. Four Noble Truths 5. Noble Eightfold Path 6. Universal Laws: Tilakkhana, Patikkasamuppada, Kamma 7. Moral and ethical principles (Sila, Buddhist Pancasila) 8. Meditation (Samadhi) and development of wisdom (Pañña) 9. Buddhist social teachings and interfaith harmony 10. Acculturation of Buddhism in Indonesia 11. Contribution of Buddhism to the Republic of Indonesia 12. Contemporary issues and Buddhist solutions
<p>Examination forms</p>	<p>Mid-Semester Examination, Final Examination, Quizzes, Assignments, Case Analysis, Project-Based Assessment, Presentation</p>

<p>Study and examination requirements</p>	<ul style="list-style-type: none"> • Attendance and active participation • Completion of individual and group assignments • Participation in meditation practice sessions • Completion of a group project (“Actualizing Dhamma: Buddhist Solutions to Contemporary Issues”) • Passing midterm and final examinations
<p>Reading list</p>	<p>Main References:</p> <ul style="list-style-type: none"> • Compilation Team (2016). <i>Buddhist Religious Education and Character Education</i>. Ministry of Education and Culture. • Narada Mahathera (2005). <i>The Buddha and His Teachings</i>. Dhammadipa Arama Foundation. • Walpola Rahula (1993). <i>What the Buddha Taught</i>. Dhammadipa Arama Foundation. • Sri Pannavaro Mahathera (2010). <i>Humans, Religion, and Happiness</i>. Tipitaka Library Foundation. <p>Primary Scripture:</p> <ul style="list-style-type: none"> • Tipitaka (Buddhist Holy Scriptures)

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Catholic Religious Education
Module level	Bachelor/Undergraduate
Code	30112101
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Dr. Rymond Rumampuk, M.Si
Lecturer	Dr. Rymond Rumampuk, M.Si Yosephine Debbie Damayanti, M.Pd.
Language	<i>English / Indonesian</i>
Relation to curriculum	<i>Compulsory Course (University General Course)</i>
Teaching methods	<i>Lecture, discussion, project-based learning (PBL), case study, reflective paper, group presentation</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>
Module objectives/intended learning outcomes	<p>After completing this module, students are able to:</p> <p>Knowledge: <i>Understand the basic concepts and values of Catholicism, and their relation to science and national life.</i></p> <p>Skills: <i>Apply Catholic values reflectively in academic and social contexts; develop critical and analytical thinking to integrate faith and science.</i></p> <p>Competences: <i>Demonstrate resilient, collaborative, innovative, and inclusive Catholic attitudes; continuously develop themselves through Catholic devotional practices.</i></p>

<p>Content</p>	<ol style="list-style-type: none"> 1. <i>Basic Concepts of Catholicism and Academic Identity</i> 2. <i>Catholicism in National Life</i> 3. <i>Application of Catholic Values in Social and National Contexts</i> 4. <i>Resilient, Collaborative, Innovative, and Inclusive Catholic Character</i> 5. <i>Celibacy and Its Relevance in Catholic Life</i> 6. <i>The Relationship Between Science and Faith</i> 7. <i>Critical Thinking vs Radical Thinking</i> 8. <i>Continuous Self-Development in Devotional Practice</i> 9. <i>Living Catholic Faith Values in Everyday Life</i> 10. <i>Integration of Faith, Knowledge, and National Life</i>
<p>Examination forms</p>	<p><i>Written exam, oral presentation, project report, class participation, and portfolio assessment</i></p>
<p>Study and examination requirements</p>	<ul style="list-style-type: none"> - <i>Minimum attendance 80%</i> - <i>Active participation in discussions and project work</i> - <i>Submission of reflective papers and group presentations</i> - <i>Mid-semester and final examinations</i> - <i>Continuous assessment of participation, assignments, and reflection journals</i>
<p>Reading list</p>	<p>Main References:</p> <ul style="list-style-type: none"> • <i>KWI. (1996). Catholic Faith. Yogyakarta-Jakarta: Kanisius & Obor.</i> • <i>Rausch, T. P. (2001). Catholicism. Yogyakarta: Kanisius.</i> • <i>Powell, J. (1998). Christian Vision. Yogyakarta: Kanisius.</i> • <i>Paulus, J. P. (1983). Code of Canon Law (Codex Iuris Canonici). Jakarta: Obor.</i> • <i>KWI. (1996). Guidelines for the Indonesian Catholic Church. Jakarta: Obor.</i> • <i>Directorate General of Learning and Student Affairs. (2016). Catholic Religious Education for Higher Education. Jakarta.</i>

Bachelor of Chemistry

MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Christian Religious Education
Module level	Bachelor/Undergraduate
Code	30112101
Semester(s) in which the module is taught	1 st semester
Person responsible for the module	<i>Drs. Dokri Gumolung, S.Th, M.Si</i>
Lecturer	<i>Drs. Dokri Gumolung, S.Th, M.Si.; Andre Patanda, M.Pd</i>
Language	Indonesian
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lectures, interactive discussions, case-based learning, project-based learning, reflective writing, simulation, and group work</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>

<p>Module objectives/intended learning outcomes</p>	<p>After completing this module, students are expected to: <i>Knowledge: Explain the theological and historical foundation of Christian faith and education; understand the Bible as the source of moral and spiritual guidance.</i></p> <p><i>Skills: Analyze contemporary moral and social issues from a Christian perspective; design community service projects based on Christian values.</i></p> <p><i>Competences: Demonstrate faith-based integrity, tolerance, and ethical awareness in professional and academic contexts; apply Christian values in personal life and pluralistic society.</i></p>
<p>Content</p>	<ol style="list-style-type: none"> 1. Introduction to Christian Religious Education (objectives and scope) 2. The basis of Christian faith (Bible, Christology, Soteriology) 3. The Bible as the guide to life 4. Christian ethics and character building 5. Christian faith in the context of pluralism and tolerance 6. Contemporary social and moral issues (corruption, hedonism, intolerance) 7. The spirit of service and love 8. Vision of Christian faith and profession 9. Digital ethics, environmental ethics, and bioethics 10. Interfaith dialogue 11. Personal and community spirituality 12. Integrating faith and life through written and project-based work
<p>Examination forms</p>	<p><i>Written test, oral presentation, reflection paper, individual and group assignments, performance/project-based assessment</i></p>
<p>Study and examination requirements</p>	<ul style="list-style-type: none"> - <i>Minimum attendance 80%</i> - <i>Active participation in discussions and group activities</i> - <i>Submission of reflective papers and project reports</i> - <i>Mid-semester and final examinations</i> - <i>Continuous assessment of performance, assignments, and reflection journals</i>
<p>Reading list</p>	<p>Main References:</p> <ol style="list-style-type: none"> 1. <i>The Holy Bible</i> 2. <i>Brotosudarmo, D.S. (2008). Christian Religious Education for Higher Education. ANDI.</i> 3. <i>Emiyati, A. et al. (2021). Christian Religious Education in a Pluralistic Society. Widina Media Utama.</i> 4. <i>Marsaulina, R. (2025). Christian Religious Education in Higher Education. Widina Media Utama.</i>

5. Romika, R., Siringo Ringo, S., & Sianturi, R.T. (2025). *Christian Religious Education in the Digital Age*. Widina Media Utama. 6. Sihombing, lin N.I. (2022). *Christian Ethics*. Eureka Media Aksara.

Supporting References:

Other relevant textbooks and academic journals.

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Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Islamic Religious Education
Module level	Bachelor/Undergraduate
Code	30112101
Semester(s) in which the module is taught	1 st semester
Person responsible for the module	Prof. Dr. Feti Fatimah, M.Si
Lecturer	Prof. Dr. Feti Fatimah, M.Si, Prof. Dr. Sanusi Gugule, M.S
Language	Indonesian/English
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lectures, interactive discussions, case-based learning, project-based learning, reflective writing, simulation, and group work</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>
Module objectives/intended learning outcomes	<p><i>After completing this module, students are expected to:</i></p> <p><i>Knowledge:</i></p> <ul style="list-style-type: none"> • <i>Explain the theological and historical foundations of Islamic faith and education.</i> • <i>Understand the Qur'an and Hadith as sources of moral and spiritual guidance.</i> <p><i>Skills:</i></p> <ul style="list-style-type: none"> • <i>Analyze contemporary moral and social issues from an Islamic perspective.</i> • <i>Design community service projects based on</i>

	<p><i>Islamic values.</i></p> <p>Competences:</p> <ul style="list-style-type: none"> • <i>Demonstrate faith-based integrity, tolerance, and ethical awareness in professional and academic contexts.</i> • <i>Apply Islamic values in personal life and pluralistic society.</i>
Content	<ol style="list-style-type: none"> 1. <i>Introduction to Islamic Religious Education (objectives and scope)</i> 2. <i>Foundations of Islamic faith (Qur'an, Hadith, Aqidah, Shariah)</i> 3. <i>The Qur'an and Hadith as guides to life</i> 4. <i>Islamic ethics and character building (akhlaq)</i> 5. <i>Islam in the context of pluralism and tolerance</i> 6. <i>Contemporary social and moral issues (corruption, consumerism, intolerance)</i> 7. <i>The spirit of service ('amal shalih) and compassion (rahmah)</i> 8. <i>Vision of Islamic faith and profession</i> 9. <i>Digital ethics, environmental ethics, and bioethics in Islam</i> 10. <i>Interfaith dialogue from an Islamic perspective</i> 11. <i>Personal and community spirituality (ibadah and muamalah)</i> 12. <i>Integrating faith and life through written and project-based work</i>
Examination forms	<p><i>Written test, oral presentation, reflection paper, individual and group assignments, performance/project-based assessment</i></p>
Study and examination requirements	<ul style="list-style-type: none"> - <i>Minimum attendance 80%</i> - <i>Active participation in discussions and group activities</i> - <i>Submission of reflective papers and project reports</i> - <i>Mid-semester and final examinations</i> - <i>Continuous assessment of performance, assignments, and reflection journals</i>
Reading list	<ol style="list-style-type: none"> 1. <i>Al-Qur'an al-Karim</i> 2. <i>Al-Hadith (selected collections)</i> 3. <i>Azra, A. (2019). Islamic Religious Education in Higher Education. Prenada Media.</i> 4. <i>Rahman, F. (2022). Islamic Ethics and Contemporary Society. Kencana.</i> 5. <i>Hidayat, K. (2021). Pluralism and Islamic Religious Education. Gramedia.</i> <p>Supporting References: <i>Other relevant textbooks and academic journals on Islamic education, ethics, and interfaith dialogue.</i></p>

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Hindu Religious Education
Module level	Bachelor/Undergraduate
Code	30112101
Semester(s) in which the module is taught	1st semester
Person responsible for the module	Dr. IDK Anom
Lecturer	Dr. IDK Anom
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lecture, Interactive Dialogue, Group Discussion, Case Study, Reflection, Visual Learning, Project-Based Learning, Debate, Collaborative Learning</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>
Module objectives/intended learning outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> • <i>Understand the core structure of Hindu teachings: Tattwa, Susila, and Acara.</i> • <i>Explain fundamental concepts (Brahman, Atman, Trimurti, cosmology, karma, samsara, moksha).</i> • <i>Describe Hindu ethics (Tri Kaya Parisudha, Catur Paramita) and the meaning of Yadnya.</i> <p>Skills:</p> <ul style="list-style-type: none"> • <i>Analyze Hindu rituals, socio-cultural functions, and</i>

	<p>cosmological concepts.</p> <ul style="list-style-type: none"> • Interpret Hindu values for ethical decision-making in social and academic life. • Design projects based on Hindu values for community engagement. <p>Competences:</p> <ul style="list-style-type: none"> • Demonstrate tolerance and open-mindedness in pluralistic contexts. • Integrate Hindu spirituality with modern societal challenges, globalization, and technology. • Exhibit collaborative, critical, reflective, and ethical thinking aligned with Hindu philosophical values.
Content	<ol style="list-style-type: none"> 1. Structure of Hindu teachings (Tattwa, Susila, Acara) 2. Brahman, Atman, Trimurti, macrocosm-microcosm 3. Hindu cosmology: Panca Mahabhuta, Tri Loka, Tri Hita Karana 4. Human concept: Tri Sarira, Panca Kosha, Catur Purusartha 5. Karma, Samsara, Moksha 6. Hindu ethics: Tri Kaya Parisudha, Catur Paramita 7. Socio-professional ethics and Hindu moral values 8. Yadnya: Dewa, Bhuta, Manusa, Pitra, Rsi 9. Dharma Shanti and harmony in Hindu teachings 10. Diversity of Hindu practices in the Indonesian archipelago 11. Hinduism in the modern era and contemporary challenges 12. Global issues: pluralism, ecology, technology from a Hindu perspective 13. Designing Hindu value-based community projects
Examination forms	<p>Mid-Semester Exam, Final Exam, Quizzes, Assignments, Reflection Tasks, Case Study Analysis, Project/Portfolio Assessment, Presentations, Performance Evaluation</p>
Study and examination requirements	<ul style="list-style-type: none"> • Active participation in lectures and discussions • Completion of assignments (individual & group) • Participation in debates, presentations, and project development • Completion of a Hindu value-based community project • Meeting attendance requirement (>75%) • Passing midterm and final examinations
Reading list	<p>Main References:</p> <ul style="list-style-type: none"> • Titib, I Made. (1996). <i>Vedas and Upanishads: An Overview</i>. Paramita. • Gede Pudja. (2005). <i>Manawa Dharmasastra</i>. Paramita. • Alit Susanta. (2010). <i>Hindu Ethics in the Contemporary Context</i>. Widya Dharma. • Ministry of Religious Affairs (2020). <i>Hindu Religious Education Module for Higher</i>

Education.

- Sudiarta, I Nengah. (2021). *Ritual and Symbolism in Hindu Ceremonies in the Archipelago*. Udayana Press.

Supporting References:

- Sura, I Wayan. (2012). *Hinduism and Multiculturalism*. Bali Post Library.
- Suhardana, I Ketut. (2016). *Ecological Theology in Hinduism*. Pustaka Pelajar.
- Sudharta, I Gusti Putu. (2004). *Catur Purusartha: Hindu Philosophy of Life*. Dharma Acarya Foundation.
- Karma Yoga Dwijendra Foundation. (2019). *Actual Hinduism*. Dharma Duta.
- Putra, I Made Dana. (2020). *Hinduism in the Framework of Character Education*. Widya Dharma.
- Sedyawati, Edi. (2006). *Religion and Culture of the Indonesian Archipelago*. Obor Foundation.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Khonghucu Religion
Module level	Bachelor/Undergraduate
Code	-
Semester(s) in which the module is taught	1st semester
Person responsible for the module	<i>Yosephine Debbie Damayanti, M.Pd.</i>
Lecturer	<i>Yosephine Debbie Damayanti, M.Pd.</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lecture, Small Group Discussion, Cooperative Learning, Contextual Learning, Discovery Learning, Project-Based Learning, Self-directed Learning</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>

<p>Module objectives/intended learning outcomes</p>	<p>Knowledge:</p> <ul style="list-style-type: none"> • Concept of Tian-Di-Ren, purpose of life, afterlife, human nature • Confucian views on education, law, politics, science, economy, environment <p>Skills:</p> <ul style="list-style-type: none"> • Analyze ethical principles (Wu Chang, Ba De) • Interpret history, scriptures, contributions to civilization <p>Competences:</p> <ul style="list-style-type: none"> • Demonstrate Confucian moral values • Promote harmony, tolerance, and ethical behavior
<p>Content</p>	<ol style="list-style-type: none"> 1. Concept of God in Confucianism (Tian-Di-Ren) 2. Purpose of life and the afterlife 3. Five Virtues (Wu Chang) and Eight Virtues (Ba De) 4. Human nature and social relationships 5. Sacred history, scriptures, development in Indonesia 6. Education, socio-culture, law, politics 7. Science, technology, economics, environment 8. Morality, plurality, diversity, civilization contribution 9. Jingzuo meditation 10. Worship ceremonies 11. Confucian organizations and spiritual hierarchy
<p>Examination forms</p>	<p>Mid-Semester Exam, Final Exam, Quizzes, Assignments, Performance Assessment, Project/Product Assessment, Portfolio</p>
<p>Study and examination requirements</p>	<ul style="list-style-type: none"> • Class attendance and active participation • Completion of individual and group assignments • Passing mid-term and final exams • Demonstration of ethical conduct and collaborative engagement
<p>Reading list</p>	<p>Main:</p> <ul style="list-style-type: none"> • Si Shu - The Four Books (Matakin, 2012) • Confucian Religious Ceremony Procedures (Matakin, 1984) • Xiao Jing - Book of Filial Piety (Matakin, 1984) <p>Supporting:</p> <ul style="list-style-type: none"> • Nio Joe Lan, Chinese Civilization at a Glance (2013) • Open Material on Tax Awareness for Universities (DJP, 2016)

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Civics Education
Module level	Bachelor/Undergraduate
Code	30112103
Semester(s) in which the module is taught	1st Semester
Person responsible for the module	<i>Prof. Dr. Sanusi Gugule, M.S</i>
Lecturer	<i>Prof. Dr. Sanusi Gugule, M.S.; Dr. Anderson A. Aloanis, M.Si.</i>
Language	Indonesian/ English
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lectures, discussions, case-based learning, problem-based learning, project-based learning, and reflection sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>
Module objectives/intended learning outcomes	<p>After completing this module, students are expected to:</p> <p>Knowledge: <i>Understand the concepts of citizenship, national identity, the Constitution, democracy, and human rights in the context of Indonesia.</i></p> <p>Skills: <i>Analyze and evaluate constitutional principles, democratic practices, and the implementation of citizens' rights and obligations in national life.</i></p> <p>Competences: <i>Demonstrate responsible citizenship attitudes, uphold Pancasila and the 1945 Constitution,</i></p>

	<p><i>and participate actively in building democracy and human rights awareness in Indonesia.</i></p>
Content	<ol style="list-style-type: none"> 1. <i>State and Citizenship: Concept of the unitary state and uniqueness of the Indonesian legal system based on Pancasila values.</i> 2. <i>The Constitution and the 1945 Constitution of the Republic of Indonesia: The importance of the Constitution, constitutional behavior, and legal consistency.</i> 3. <i>National Identity: The role of culture and national integration in globalization; maintaining Indonesian identity in popular culture.</i> 4. <i>Democracy: Meaning, essence, and practice of democracy based on Pancasila and the 1945 Constitution; participation and consensus decision-making.</i> 5. <i>Human Rights: Pancasila as the philosophical foundation of human rights; balancing rights and obligations; analysis of human rights violations.</i>
Examination forms	<p><i>Written test, oral presentation, paper, individual and group assignments, performance/project-based assessment</i></p>
Study and examination requirements	<ul style="list-style-type: none"> - <i>Minimum attendance 75%</i> - <i>Active participation in discussions, case studies, and projects</i> - <i>Completion of individual and group assignments</i> - <i>Mid-term and final examinations</i> - <i>Continuous assessment of participation, reflection, and task performance</i>
Reading list	<p>Main References:</p> <ol style="list-style-type: none"> 1. <i>Ministry of Research, Technology, and Higher Education. (2016). Civic Education for Higher Education.</i> 2. <i>The 1945 Constitution of the Republic of Indonesia.</i> 3. <i>Citizenship Law; Human Rights Law and related national legislation.</i> <p>Supporting References:</p> <p><i>Additional relevant textbooks, policy papers, and academic journals on citizenship, democracy, and human rights.</i></p>

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Mathematics for Chemistry
Module level	Bachelor/Undergraduate
Code	30122104
Semester(s) in which the module is taught	1 st semester
Person responsible for the module	Dra. Vivian Regar M.Pd.
Lecturer	Dra. Vivian Regar M.Pd.
Language	Indonesian/ English
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lectures, tutorials, small group discussions, problem-based learning, discovery learning, contextual learning, and project-based tasks.</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>no</i>
Module objectives/intended learning outcomes	<p>After completing this module, students are expected to:</p> <p>Knowledge: <i>Understand mathematical concepts and methods relevant to chemistry, including algebra, calculus, matrices, differential equations, and data analysis.</i></p> <p>Skills: <i>Apply mathematical principles to analyze and solve chemical problems quantitatively; perform calculations, derivations, and data interpretation accurately.</i></p> <p>Competences: <i>Integrate mathematical reasoning in</i></p>

	<p>scientific thinking, demonstrate problem-solving abilities, and use mathematical tools to support research and laboratory work.</p>
Content	<ol style="list-style-type: none"> 1. Numbers, measurements, and numerical mathematics. 2. Mathematical symbols and functions. 3. Solving algebraic equations. 4. Functions and differential calculus. 5. Integral calculus. 6. Power series and transformations (Fourier, Laplace). 7. Multivariable calculus. 8. Differential equations. 9. Operators, matrices, and group theory. 10. Solving simultaneous algebraic equations. 11. Experimental data processing and statistical analysis.
Examination forms	<p>Written test, quizzes, oral presentations, project-based assessments, and participation.</p>
Study and examination requirements	<ul style="list-style-type: none"> - Minimum attendance 75% - Active participation in discussions, exercises, and assignments - Submission of structured and independent tasks - Mid-semester and final examinations - Continuous assessment of performance, class activities, and project results
Reading list	<p>Main References:</p> <ul style="list-style-type: none"> • Barrante, J.R. (1998). <i>Applied Mathematics for Physical Chemistry</i>. New Jersey: Prentice Hall. • Mortimer, R.G. (2005). <i>Mathematics for Physical Chemistry</i>. Elsevier Inc. <p>Supporting References:</p> <ul style="list-style-type: none"> • Kreyszig, E. (1994). <i>Advanced Engineering Mathematics</i>. New York: John Wiley. • Boaz, M.L. (1996). <i>Mathematics for Physical Sciences</i>. New York: John Wiley. • Doggett, G. & Sutcliffe, B.T. (1996). <i>Mathematics for Chemistry</i>. Harlow: Longman.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Pancasila Education
Module level	Bachelor/Undergraduate
Code	30112102
Semester(s) in which the module is taught	1st semester
Person responsible for the module	<i>Prof. Dr. Sanusi Gugule, M.S</i>
Lecturer	<i>Prof. Dr. Sanusi Gugule, M.S.; Dr. Anderson A. Aloanis, M.Si.</i>
Language	Indonesian/English
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lectures, discussions, case-based learning, problem-based learning, project-based learning, and reflection sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>none</i>
Module objectives/intended learning outcomes	<p>After completing this module, students are expected to:</p> <p>Knowledge: <i>Understand and evaluate the historical, philosophical, ideological, ethical, and scientific foundations of Pancasila as the national ideology.</i></p> <p>Skills: <i>Critically analyze contemporary social, political, and scientific issues from the perspective of Pancasila values.</i></p>

	<p>Competences: Demonstrate the ability to apply Pancasila principles in academic, professional, and societal contexts; develop critical and innovative attitudes rooted in Pancasila ethics and values.</p>
Content	<p>1. Pancasila in Historical Studies: Pre-Independence, Old Order, New Order, and Reformation periods.</p> <p>2. Pancasila as a Philosophical System: Ontological, epistemological, and axiological foundations; the essence of Pancasila principles.</p> <p>3. Pancasila as an Ideology: Characteristics and openness of Pancasila ideology; differences from other world ideologies; relationship with religion.</p> <p>4. Pancasila as the State Foundation: Legal position; relation to the Preamble of the 1945 Constitution of the Republic of Indonesia.</p> <p>5. Pancasila as an Ethical System: Pancasila values of divinity, humanity, unity, democracy, and justice; ethics and moral reasoning; comparison with other ethical systems.</p> <p>6. Pancasila as the Foundation of Science and Technology: Value-free and value-based science; implementation of Pancasila in scientific development and innovation.</p>
Examination forms	Written examination, oral presentation, reflective essay, class participation, and project-based assessment
Study and examination requirements	<ul style="list-style-type: none"> - Minimum attendance 80% - Active participation in discussions and case studies - Submission of essays, analysis papers, and projects - Mid-term and final examinations - Continuous assessment of performance and participation
Reading list	<p>Main References:</p> <ol style="list-style-type: none"> 1. Dikti. (2016). Pancasila Education Book. 2. Hariyono. (2014). Pancasila Ideology: The Progressive Spirit of Indonesian Nationalism. Malang: Intrans. 3. Kaelan. (2013). Pancasila Nation State. Yogyakarta: Paradigma. <p>Supporting References: Additional academic sources, journals, and policy documents relevant to the study of Pancasila in philosophy, ethics, and science.</p>

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Physics for Chemistry
Module level	Bachelor/Undergraduate
Code	30122105
Semester(s) in which the module is taught	1st semester
Person responsible for the module	<i>Rejeki Tumanggor, M.Pd.</i>
Lecturer	<i>Alfrie Musa Rampengan, S.Si., M.Sc; Rejeki Tumanggor, M.Pd.</i>
Language	Indonesian
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lectures, problem-based learning (PBL), discussions, demonstrations, small group projects, simulations, and assignments.</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	No
Module objectives/intended learning outcomes	<p>After completing this module, students are expected to:</p> <p>Knowledge: Understand the fundamental laws and concepts of mechanics, fluids, waves, and thermodynamics relevant to chemistry.</p> <p>Skills: Apply physical laws and mathematical analysis to describe and solve problems in chemical systems.</p> <p>Competences: Integrate mathematical reasoning in scientific thinking, demonstrate problem-solving abilities, and use physics tools to support research and laboratory work.</p>

Content	<ol style="list-style-type: none"> 1. One- and two-dimensional motion of objects. 2. Newton's Laws of Motion (1st, 2nd, and 3rd). 3. Work, energy, and conservation of energy. 4. Systems of particles and collisions. 5. Rotation, kinematics, and dynamics of rigid bodies. 6. Equilibrium, elasticity, and Hooke's Law. 7. Static and dynamic fluids: Pascal's, Archimedes', Bernoulli's, Poiseuille's, and Stokes' laws. 8. Simple harmonic motion, damped vibrations, and resonance. 9. Waves and wave propagation. 10. Temperature, thermal equilibrium, heat, and heat transfer. 11. Introduction to the laws of thermodynamics and application
Examination forms	Written test, quizzes, oral presentations, project-based assessment, participation, and final exam.
Study and examination requirements	<ul style="list-style-type: none"> - Minimum attendance 75% - Active participation in class discussions and problem-solving - Submission of individual and group assignments (e.g., papers, simulations, PPTs) - Mid-semester and final examinations - Continuous assessment based on class performance and project output
Reading list	<p>Main References:</p> <ul style="list-style-type: none"> • Tipler, P.A. (1991). <i>Physics for Scientists and Engineers</i>. Worth Publishers. (Erlangga translated edition) • Halliday, D. & Resnick, R. (2005). <i>Fundamentals of Physics</i>. Wiley. • Walker, J.S. (2008). <i>Physics</i>. Addison-Wesley. <p>Supporting References:</p> <ul style="list-style-type: none"> • Schaum's Outline Series. (1999). <i>Physics for Engineers</i>. McGraw-Hill. • Giancoli, D.C. (1999). <i>Physics, Vol. 1</i>. Erlangga.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Basic Chemistry Practicum
Module level	<i>Bachelor/ Undergraduate</i>
Code	30132108
Semester(s) in which the module is taught	<i>1st Semester</i>
Person responsible for the module	<i>Dr. Rymond Rumampuk, M.Si</i>
Lecturer	<i>Dr. Rymond Rumampuk, M.Si Abdon Saiya, M.Si Stefan Rumengan, M.Si</i>
Language	<i>Indonesian/English</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Laboratory experiments, discussions, report writing, project-based and collaborative learning.</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>no</i>
Module objectives/intended learning outcomes	<p><i>Students are able to:</i></p> <ul style="list-style-type: none"> • <i>Demonstrate responsibility, discipline, and independence in learning chemistry.</i> • <i>Understand atomic structure and periodic system of elements.</i> • <i>Determine chemical bonding types and predict physical/chemical properties.</i> <ul style="list-style-type: none"> • <i>Apply laws of chemistry in stoichiometric calculations.</i> • <i>Apply concepts of thermodynamics to predict reaction spontaneity.</i>

	<ul style="list-style-type: none"> Analyse and interpret chemical equilibrium behaviour Communicate experimental results through written and oral reports.
Content	<p>The course includes practical work on:</p> <ol style="list-style-type: none"> Atomic Structure & Periodic System Chemical Bonding & Molecular Structure Stoichiometry Chemical Thermodynamics Chemical Equilibrium
Examination forms	<p>Practical performance assessment, written report, oral presentation, mid-term and final exams.</p>
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> Attend at least 80% of practical sessions. Complete and submit all practical reports. Pass mid-term and final evaluations. Demonstrate proper laboratory conduct and safety compliance.
Reading list	<p>Main References:</p> <ol style="list-style-type: none"> Chang, R. (2010). <i>Chemistry, 10th Ed.</i>, McGraw-Hill. Jespersen, N.D., Brady, J., & Hyslop, A. (2012). <i>Chemistry</i>. Wiley. <p>Supporting References:</p> <ul style="list-style-type: none"> Lecture notes and additional materials provided by lecturers.

Module Handbook

Bachelor of Chemistry

2nd Semester

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Indonesian Language
Module level	<i>Bachelor (Undergraduate)</i>
Code	30112209
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Dr. J.Z. Lombok, M.Si</i>
Lecturer	<i>Dr. J.Z. Lombok, M.Si; J. Kumayas, S.P., M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p><i>After completing this module, students are expected to:</i></p> <p><i>Knowledge: Understand the nature, position, and function of the Indonesian language, as well as standard Indonesian and its application in academic contexts.</i></p> <p><i>Skills: Produce academic and professional texts in various macro genres, such as research proposals, reports, and scientific articles.</i></p> <p><i>Competences: Communicate ideas effectively in written and spoken Indonesian according to</i></p>

	<i>academic conventions and participate in scientific discourse using proper Indonesian.</i>
Content	<ul style="list-style-type: none"> - <i>The nature, position, and function of Indonesian</i> - <i>Standard Indonesian and its varieties</i> - <i>Academic texts in macro genres</i> - <i>Library research and information literacy</i> - <i>Designing proposals for research and activities</i> - <i>Reporting research results and outcomes</i> - <i>Writing scientific articles</i> - <i>Indonesian Language Proficiency Test (UKBI) practice</i>
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - <i>Attendance \geq 80%</i> - <i>Completion of all tasks and quizzes</i> - <i>Participation in discussions and projects</i> - <i>Mid-term exam (UTS) and Final exam (UAS)</i> - <i>Pass mark: minimum grade C</i>
Reading list	<p><i>Main References:</i></p> <ol style="list-style-type: none"> <i>1. Compilation Team. (2016). Indonesian for College. Jakarta: Ministry of Research, Technology and Higher Education.</i> <i>2. Indonesian Language MKU Teaching Team. (2015). Indonesian: MPK Indonesian Language Teaching Materials. Jakarta: UPT MKU UNJ.</i> <i>3. Amran Tasai. (2000). Be Careful in Speaking Indonesian in College. Jakarta: MSP.</i> <i>4. Dendy Sugono. (1989). Speak Indonesian Correctly. Jakarta: PT Priastu.</i> <i>5. Ministry of National Education. (2006). Reference Dictate. Directorate General of Higher Education, Directorate of Manpower.</i>

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Philosophy of Science and Mathematics (MIPA)
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132221
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Prof. Dr. Sanusi Gugule, M.S</i>
Lecturer	<i>Prof. Dr. Sanusi Gugule, M.S; Prof. Dr. Feti Fatimah, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p><i>After completing this module, students are expected to:</i></p> <p>Knowledge</p> <ul style="list-style-type: none"> <i>Understand the philosophical foundations of mathematics and natural sciences.</i> <i>Explain the historical development of scientific thought and paradigms.</i> <i>Recognize the role of logic, epistemology, and ethics in MIPA disciplines.</i> <p>Skills</p>

	<ul style="list-style-type: none"> Analyze scientific problems using philosophical reasoning. Critically evaluate assumptions, methods, and implications of scientific inquiry. Communicate philosophical perspectives in academic discussions and writing. <p>Competences</p> <ul style="list-style-type: none"> Integrate philosophical reflection into scientific practice. Demonstrate ethical awareness in the application of science and mathematics. Contribute to interdisciplinary dialogue between science, philosophy, and society.
Content	<ol style="list-style-type: none"> Introduction to philosophy of science and mathematics Historical perspectives: classical, modern, and contemporary science Logic and reasoning in MIPA Epistemology: sources and limits of scientific knowledge Ontology: nature of reality in mathematics and science Ethics and responsibility in scientific practice Paradigm shifts and scientific revolutions (Kuhn, Popper, Lakatos) Interdisciplinary perspectives: science, technology, and society Philosophy of chemistry, physics, and mathematics Case studies in scientific controversies and ethical dilemmas
Examination forms	Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance
Study and examination requirements	<ul style="list-style-type: none"> Attendance $\geq 80\%$ Completion of all tasks and quizzes Participation in discussions and projects Mid-term exam (UTS) and Final exam (UAS) Pass mark: minimum grade C

Reading list	<p>Main References</p> <ol style="list-style-type: none">1. Chalmers, A.F. (2013). <i>What Is This Thing Called Science?</i> Open University Press.2. Popper, K. (2002). <i>The Logic of Scientific Discovery.</i> Routledge.3. Kuhn, T.S. (2012). <i>The Structure of Scientific Revolutions.</i> University of Chicago Press.4. Lakatos, I. (1978). <i>The Methodology of Scientific Research Programmes.</i> Cambridge University Press.5. Suriasumantri, J.S. (2010). <i>Filsafat Ilmu: Sebuah Pengantar Populer.</i> Pustaka Sinar Harapan. <p>Supporting References</p> <ul style="list-style-type: none">• Selected journal articles on philosophy of science and mathematics.• Indonesian sources on philosophy of MIPA and scientific ethics.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Monofunctional Organic Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133215
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Dr. Emma J. Pongoh, M.Si</i>
Lecturer	<i>Prof. Dr. Sanusi Gugule, M.S; Dr. Emma J. Pongoh, M.Si; Dr. Rymond Rumampuk, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program; belongs to the Organic Chemistry research group</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry and Biology for Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the structure, nomenclature, and classification of monofunctional organic compounds (alkanes, alkenes, alkynes, alcohols, aldehydes, ketones, carboxylic acids, amines, etc.). • Explain the physical and chemical properties of monofunctional organic compounds. • Describe the fundamental reaction mechanisms (substitution, addition, elimination, oxidation, reduction) relevant to monofunctional groups.

	<p>Skills</p> <ul style="list-style-type: none"> Analyze reaction pathways and predict products of monofunctional organic reactions. Apply spectroscopic methods (IR, NMR, MS) to identify and characterize monofunctional organic compounds. Design synthetic routes for simple monofunctional compounds based on functional group transformations. <p>Competences</p> <ul style="list-style-type: none"> Integrate theoretical knowledge with practical laboratory work to solve problems in organic synthesis and analysis. Evaluate the reactivity and selectivity of monofunctional compounds in various chemical contexts. Demonstrate scientific reasoning, ethical awareness, and accuracy in reporting experimental results.
Content	<ol style="list-style-type: none"> Introduction to organic compounds and bonding Alkanes & cycloalkanes: structure, properties, reactions Alkenes: addition reactions, polymerization Alkynes: acidity, addition reactions Aromatic compounds: resonance, substitution, orientation effects Alcohols & phenols: preparation, oxidation, esterification Aldehydes & ketones: nucleophilic addition, oxidation/reduction Carboxylic acids & derivatives: acidity, esterification, amidation Amines: structure, basicity, diazonium chemistry
Examination forms	<p><i>Mid-term and final written exams, individual/group assignments, Practicum report</i></p>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C

Reading list	<p>Main Reference:</p> <ol style="list-style-type: none"> 1. Pongoh, E.J., Rumampuk, R.J., Tarigan, P., Herlt, A.J., & Mander, L.N. (2002). Two Major Saponins from Seeds of <i>Barringtonia asiatica</i>: Putative Antifeedants toward <i>Epilachna</i> sp. Larvae. <i>Journal of Natural Products</i>, 65(2), 115-120. 2. Pongoh, E.J., Rumampuk, R.J., Tarigan, P. (2010). A Triterpene Ester Saponin from the Seed of <i>Barringtonia asiatica</i>. <i>Indonesian Journal of Chemistry</i>, 3(3), 149-155. 3. Rumampuk, R.J., Safitri, R., Tarigan, P., Freisleben, H.J., Murakami, A. (2003). Antioxidant Activity in vitro of Two Aromatic Compounds from <i>Caesalpinia sappan</i> L. <i>Biofactors</i>, 19(1-2), 71-77. 4. Rumampuk, R.J., Jenie, U.A., Kardono, L.B.S., Hanafi, M., Darmawan, A. (2014). <i>Teknik Modern Spektroskopi NMR: Teori dan Aplikasi dalam Elusidasi Struktur Molekul Organik</i>. LIPI Press. 5. Pongoh, E.J., Rumampuk, R.J., Howan, D., Tamunu, V. (2019). <i>Skrining Fitokimia dan Potensi Antilitiasis dari Ekstrak Etanol Daun Nusa Indah Putih (Mussaenda pubescens)</i>. <i>Fullerene Journal of Chemistry</i>, 4(2), 76-81. 6. Rumampuk, R.J., Mamujaja, M.N., Herlina, T., Maksum, I.P., Rukayadi, Y. (2024). Flavonoids from <i>Clerodendrum</i> Genus and Their Biological Activities. <i>ADMET and DMPK</i>, 12(6), 843-879 7. Solomons, T.W.G., Fryhle, C.B., & Snyder, S.A. (2020). <i>Organic Chemistry</i>. Wiley. 8. McMurry, J. (2021). <i>Organic Chemistry</i>. Cengage Learning. 9. Carey, F.A. & Giuliano, R.M. (2016). <i>Organic Chemistry</i>. McGraw-Hill. 10. Smith, J.G. (2023). <i>Organic Chemistry: A Mechanistic Approach</i>. Oxford University Press.
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Bachelor of Chemistry
MODULE HANDBOOK

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Module designation	Monofunctional Organic Chemistry Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133212
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Dr. Emma J. Pongoh, M.Si</i>
Lecturer	<i>Prof. Dr. Sanusi Gugule, M.S; Dr. Emma J. Pongoh, M.Si; Dr. Rymond Rumampuk, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program; belongs to the Inorganic Chemistry expertise group</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, projectbased learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry and Biology for Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand structure, nomenclature, properties, and reactions of monofunctional compounds. • Explain key reaction mechanisms (substitution, addition, elimination, oxidation, reduction). <p>Skills</p> <ul style="list-style-type: none"> • Predict reaction products and analyze pathways. • Design simple synthetic routes. <p>Competences</p> <ul style="list-style-type: none"> • Apply theory in laboratory practice.

	<ul style="list-style-type: none"> • Evaluate reactivity and selectivity. • Report results with accuracy and ethical awareness.
Content	<p><i>This practicum covers:</i></p> <ol style="list-style-type: none"> 1. Alkanes & cycloalkanes: structure, properties, reactions 2. Alkenes: addition reactions, polymerization 3. Alkynes: acidity, addition reactions 4. Aromatic compounds: resonance, substitution, orientation effects 5. Alcohols & phenols: preparation, oxidation, esterification 6. Aldehydes & ketones: nucleophilic addition, oxidation/reduction 7. Carboxylic acids & derivatives: acidity, esterification, amidation <p>Amines: structure, basicity, diazonium chemistry</p>
Examination forms	<p><i>Written exams (mid-term and final), practicum report, individual and group assignments, reports, and project-based assessments.</i></p>
Study and examination requirements	<p><i>To successfully pass the module, students must:</i></p> <ul style="list-style-type: none"> • Attend at least 80% of lectures. • Complete all assignments and project reports. • Pass mid-term and final examinations
Reading list	<p><i>Main Reference:</i></p> <ol style="list-style-type: none"> 1. Pongoh, E.J., Rumampuk, R.J., Tarigan, P., Herlt, A.J., & Mander, L.N. (2002). Two Major Saponins from Seeds of <i>Barringtonia asiatica</i>: Putative Antifeedants toward <i>Epilachna</i> sp. Larvae. <i>Journal of Natural Products</i>, 65(2), 115-120. 2. Pongoh, E.J., Rumampuk, R.J., Tarigan, P. (2010). A Triterpene Ester Saponin from the Seed of <i>Barringtonia asiatica</i>. <i>Indonesian Journal of Chemistry</i>, 3(3), 149-155. 3. Rumampuk, R.J., Safitri, R., Tarigan, P., Freisleben, H.J., Murakami, A. (2003). Antioxidant Activity in vitro of Two Aromatic Compounds from <i>Caesalpinia sappan</i> L. <i>Biofactors</i>, 19(1-2), 71-77. 4. Rumampuk, R.J., Jenie, U.A., Kardono, L.B.S., Hanafi, M., Darmawan, A. (2014). <i>Teknik Modern Spektroskopi NMR: Teori dan Aplikasi</i>

dalam *Elusidasi Struktur Molekul Organik*. LIPI Press.

5. **Pongoh, E.J., Rumampuk, R.J.,** Howan, D., Tamunu, V. (2019). *Skrining Fitokimia dan Potensi Antilitiasis dari Ekstrak Etanol Daun Nusa Indah Putih (Mussaenda pubescens)*. *Fullerene Journal of Chemistry*, 4(2), 76-81.
6. **Rumampuk, R.J.,** Mamuja, M.N., Herlina, T., Maksum, I.P., Rukayadi, Y. (2024). *Flavonoids from Clerodendrum Genus and Their Biological Activities*. *ADMET and DMPK*, 12(6), 843-879
7. Solomons, T.W.G., Fryhle, C.B., & Snyder, S.A. (2020). *Organic Chemistry*. Wiley.
8. McMurry, J. (2021). *Organic Chemistry*. Cengage Learning.
9. Carey, F.A. & Giuliano, R.M. (2016). *Organic Chemistry*. McGraw-Hill.
10. Smith, J.G. (2023). *Organic Chemistry: A Mechanistic Approach*. Oxford University Press.

Bachelor of Chemistry
MODULE HANDBOOK

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Module designation	Fundamentals of Analytical Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133219
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si.</i>
Lecturer	<i>Abdon Saiya, M.Si. Vlagia I. Paat, M.Si. Mustapa, M.Si.</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, collaborative learning, and project-based learning.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this module, students are able to:</i></p> <ul style="list-style-type: none"> <i>• Explain the basic concepts, principles, and scope of analytical chemistry and its role in science and technology.</i> <i>• Classify and apply chemical analysis methods (classical and instrumental).</i> <i>• Conduct qualitative and quantitative analyses with accuracy.</i> <i>• Apply gravimetric and volumetric techniques in determining analyte concentrations.</i>

	<ul style="list-style-type: none"> • Calculate concentrations and interpret analytical data correctly.
Content	<p><i>This course covers:</i></p> <ol style="list-style-type: none"> 1. Introduction to analytical chemistry and its objectives. 2. Classification of analytical methods: classical and instrumental. 3. Principles of qualitative and quantitative analysis. 4. Stoichiometry in chemical analysis. 5. Gravimetric analysis: principles, procedures, and calculations. 6. Volumetric (titrimetric) analysis: principles, types of titration, and standard solution preparation. 7. Calculation of molarity and analyte concentration from experimental data.
Examination forms	<p><i>Written examinations (mid-term and final), assignments, discussions, and analytical calculation exercises.</i></p>
Study and examination requirements	<p><i>To pass the module, students must:</i></p> <ul style="list-style-type: none"> • Attend at least 80% of meetings. • Complete all assignments and participate actively in discussions. • Pass mid-term and final exams with a minimum cumulative score of 60/100. • Demonstrate mastery in analytical problem solving and data interpretation.
Reading list	<p><i>Main:</i></p> <ul style="list-style-type: none"> • Christian, G.D. (2014), <i>Analytical Chemistry</i>, 7th ed., John Wiley & Sons. • Harris, D.C. (2016), <i>Quantitative Chemical Analysis</i>, 9th ed., W.H. Freeman & Co. • Saiya, A. et al. (2024). Quantitative Determination of Ascorbic Acid Content in Two Varieties of Bird's Eye Chili (<i>Capsicum frutescens</i> L.) using UV-Vis Spectrophotometry. <i>Fullerene Journal of Chemistry</i> 10 (2), 81-86 • Skoog, D.A. (2014), <i>Fundamentals of Analytical Chemistry</i>, 9th ed., Brooks/Cole. • Saiya, A & Tengker, S., (2023). Optimasi Absorpsi Ion Logam Zn Menggunakan Arang Daun Eceng Gondok (<i>Eichhornia crassipes</i>) Sebagai Absorben. <i>Fullerene Journal of Chemistry</i> 8 (2), 59-64 • Saiya, A., et al., (2018). Analisis Residu Pestisida dalam Tomat, Cabai Rawit dan Wortel dari Beberapa

Pasar Tradisional di Sulawesi Utara. Fullerene Journal of Chemistry 3 (2), 63-69

- Paat, V., & karundeng, M., (2023) Identifikasi Kandungan Timbal (Pb) Pada Lipstik Yang Beredar Di Pasar Tondano. *Fullerene Journal of Chemistry 8 (1), 27-30*

Bachelor of Chemistry
MODULE HANDBOOK

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Module designation	Analytical Chemistry Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131218
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si.</i>
Lecturer	<i>Abdon Saiya, M.Si; Vlagia I. Paat, M.Si; Mustapa, M.Si.</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Laboratory experiments, discussions, report writing, project-based and collaborative learning.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this module, students are able to:</i></p> <ul style="list-style-type: none"> <i>• Explain the basic concepts, principles, and scope of analytical chemistry and its role in science and technology.</i> <i>• Perform qualitative and quantitative analyses.</i> <i>• Conduct gravimetric and volumetric experiments accurately. • Process, validate, and interpret laboratory data.</i> <i>• Communicate experimental results through written and</i>

	oral reports.
Content	<p>The course includes practical work on:</p> <ol style="list-style-type: none"> 1. Laboratory safety and procedures (K3). 2. Calibration of volumetric glassware. 3. Qualitative analysis of cations. 4. Determination of acetic acid in vinegar (titrimetry). 5. Determination of carbonate/bicarbonate mixtures. 6. Determination of CaCO_3 in eggshells. 7. Determination of Cu content (iodometry). 8. Determination of ascorbic acid in tablets. 9. Determination of NiCl_2 content (gravimetric & volumetric). 10. Data processing, validation, reporting, and presentation of results.
Examination forms	Practical performance assessment, written report, oral presentation, mid-term and final exams.
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> • Attend at least 80% of practical sessions. • Complete and submit all practical reports. • Pass mid-term and final evaluations. • Demonstrate proper laboratory conduct and safety compliance.
Reading list	<p>Main:</p> <ul style="list-style-type: none"> • Christian, G.D. (2014), <i>Analytical Chemistry</i>, 7th ed., John Wiley & Sons. • Harris, D.C. (2016), <i>Quantitative Chemical Analysis</i>, 9th ed., W.H. Freeman & Co. • Saiya, A. et al. (2024). Quantitative Determination of Ascorbic Acid Content in Two Varieties of Bird's Eye Chili (<i>Capsicum frutescens</i> L.) using UV-Vis Spectrophotometry. <i>Fullerene Journal of Chemistry</i> 10 (2), 81-86 • Skoog, D.A. (2014), <i>Fundamentals of Analytical Chemistry</i>, 9th ed., Brooks/Cole. • Saiya, A & Tengker, S., (2023). Optimasi Absorpsi Ion Logam Zn Menggunakan Arang Daun Eceng Gondok (<i>Eichhornia crassipes</i>) Sebagai Absorben. <i>Fullerene Journal of Chemistry</i> 8 (2), 59-64 Saiya, A., et al., (2018). Analisis Residu Pestisida dalam Tomat, Cabai Rawit dan Wortel dari Beberapa Pasar Tradisional di Sulawesi Utara. <i>Fullerene Journal of Chemistry</i> 3 (2), 63-69

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Inorganic Non-Metal Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133215
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Aisyiah R.P. Utami, M.Sc.; Joice D. Caroles, M.Si; Prof. Dr. Meytij Rampe, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program; belongs to the Inorganic Chemistry expertise group</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>After completing this course, students are expected to:</i></p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> <i>Understand the structure, characteristics, reactivity, and synthesis of s- and p-block non-metal elements and compounds.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> <i>Analyze chemical properties and synthesize various non-metal compounds based on experimental data and case studies.</i> <p><i>Competences</i></p>

	<ul style="list-style-type: none"> • Apply theoretical concepts of Inorganic Chemistry I to practical and real-life cases. • Make sound scientific judgments in problem-solving through practice-oriented activities.
Content	<ul style="list-style-type: none"> - Structure and characteristics of s- and p-block non-metal elements and compounds - Reactivity and synthesis of hydrogen, oxygen, sulfur, nitrogen, phosphorus, carbon, silicon, halogens, and noble gases - Chemical bonding and periodic trends - Case studies of compound applications in daily life (e.g., fertilizers, disinfectants, semiconductors, fuel, optical fibers)
Examination forms	Mid-term and final written exams, individual/group assignments, Practicum report
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<p>Main Reference:</p> <ol style="list-style-type: none"> 1. Meisler, G.I., & Tarr, D.A. (1991). <i>Inorganic Chemistry</i>. New Jersey: Prentice Hall. 2. Brown, T.L., & Bursten, B.E. (2009). <i>Chemistry: The Central Science</i> (11th Ed.). Upper Saddle River, NJ: Pearson Prentice Hall. 3. Rampe, M., (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM 4. Effendy. (2008). <i>VSEPR Theory, Polarity and Intermolecular Forces</i> (2nd Ed.). Malang: Bayumedia Publishing. 5. Rampe, M., et al., (2025). Surface Structure and chemical composition of coconut shell charcoal using Nira Aren (<i>Arenga pinnata</i>) acid activation. <i>Journal of Chemical Technology and Metallurgy</i> 60 (2), 269-274 6. Rampe, M., et al., (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih Dan Arang Tempurung Kelapa. <i>Fullerene Journal of Chemistry</i> 9 (1), 21-25 7. Rampe, M. et al., (2022). Sifat Fisik Arang Tempurung Kelapa: Analisis FTIR, SEM-EDS, dan TG-DTA. Penerbit NEM

Bachelor of Chemistry
MODULE HANDBOOK

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Module designation	Inorganic Non-Metal Chemistry Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133214
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Aisyiah R.P. Utami, M.Sc.; Joice D. Caroles, M.Si; Prof. Dr. Meytij Rampe, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program; belongs to the Inorganic Chemistry expertise group</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, project based learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry and Mathematics for Chemists</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this Practicum, students are able to:</i></p> <ul style="list-style-type: none"> <i>• Explain the equations of state for ideal and real gases.</i> <i>• Understand the basic concepts and laws of thermodynamics.</i> <i>• Apply the First and Second Laws of Thermodynamics in chemical systems.</i> <i>• Explain thermodynamic functions (internal energy, enthalpy, entropy, Gibbs and Helmholtz free energy).</i>

	<ul style="list-style-type: none"> • Evaluate the spontaneity of reactions based on free energy and entropy changes.
Content	<p>This practicum covers:</p> <ol style="list-style-type: none"> 1. Gas equations (ideal and real gases). 2. Concepts and laws of thermodynamics. 3. First Law of Thermodynamics and related concepts (internal energy, enthalpy, thermochemistry). 4. Second Law of Thermodynamics, entropy, and spontaneity. 5. Gibbs and Helmholtz free energies and their applications.
Examination forms	Written exams (mid-term and final), practicum report, individual and group assignments, reports, and project-based assessments.
Study and examination requirements	<p>To successfully pass the module, students must:</p> <ul style="list-style-type: none"> • Attend at least 80% of lectures. • Complete all assignments and project reports. • Pass mid-term and final examinations
Reading list	<p>Main Reference:</p> <ol style="list-style-type: none"> 1. Meisler, G.I., & Tarr, D.A. (1991). <i>Inorganic Chemistry</i>. New Jersey: Prentice Hall. 2. Brown, T.L., & Bursten, B.E. (2009). <i>Chemistry: The Central Science</i> (11th Ed.). Upper Saddle River, NJ: Pearson Prentice Hall. 3. Rampe, M., (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM 4. Effendy. (2008). <i>VSEPR Theory, Polarity and Intermolecular Forces</i> (2nd Ed.). Malang: Bayumedia Publishing. 5. Rampe, M., et al., (2025). Surface Structure and chemical composition of coconut shell charcoal using Nira Aren (<i>Arenga pinnata</i>) acid activation. <i>Journal of Chemical Technology and Metallurgy</i> 60 (2), 269-274 6. Rampe, M., et al., (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih Dan Arang Tempurung Kelapa. <i>Fullerene Journal of Chemistry</i> 9 (1), 21-25 7. Rampe, M. et al., (2022). Sifat Fisik Arang Tempurung Kelapa: Analisis FTIR, SEM-EDS, dan TG-DTA. Penerbit NEM

Bachelor of Chemistry
MODULE HANDBOOK

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Module designation	Physical Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133317
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Dr. Johnny Z. Lombok, M.Si. Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia / English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, project based learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry and Mathematics for Chemists</i>

<p>Module objectives/intended learning outcomes</p>	<p>Upon completion of this course, students are able to:</p> <ul style="list-style-type: none"> • Explain the equations of state for ideal and real gases. • Understand the basic concepts and laws of thermodynamics. • Apply the First and Second Laws of Thermodynamics in chemical systems. • Explain thermodynamic functions (internal energy, enthalpy, entropy, Gibbs and Helmholtz free energy). • Evaluate the spontaneity of reactions based on free energy and entropy changes.
<p>Content</p>	<p>This course covers:</p> <ol style="list-style-type: none"> 1. Gas equations (ideal and real gases). 2. Concepts and laws of thermodynamics. 3. First Law of Thermodynamics and related concepts (internal energy, enthalpy, thermochemistry). 4. Second Law of Thermodynamics, entropy, and spontaneity. 5. Gibbs and Helmholtz free energies and their applications.
<p>Examination forms</p>	<p>Written exams (mid-term and final), oral presentations, individual and group assignments, reports, and project-based assessments.</p>
<p>Study and examination requirements</p>	<p>To successfully pass the module, students must:</p> <ul style="list-style-type: none"> • Attend at least 80% of lectures. • Complete all assignments and project reports. • Pass mid-term and final examinations with a minimum cumulative score of 60 (out of 100).
<p>Reading list</p>	<ol style="list-style-type: none"> 1. Rampe, M., (2024). Carbon Quantum Dots. Penerbit NEM 2. Rampe, M., et al., (2025). Surface Structure and chemical composition of coconut shell charcoal using Nira Aren (<i>Arenga pinnata</i>) acid activation. <i>Journal of Chemical Technology and Metallurgy</i> 60 (2), 269-274 3. Rampe, M., et al., (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih Dan Arang Tempurung Kelapa. <i>Fullerene Journal of Chemistry</i> 9 (1), 21-25 4. Rampe, M. et al., (2022). Sifat Fisik Arang Tempurung Kelapa: Analisis FTIR, SEM-EDS, dan TG-DTA. Penerbit NEM 5. Ijang Rohman & Sri Mulyani (2000), <i>Physical Chemistry I</i>. 6. Atkins, P.W. (1986), <i>Physical Chemistry</i>, W.H. Freeman & Co.

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| | <ol style="list-style-type: none">7. <i>Alberty, R.A. (1987), Physical Chemistry, John Wiley & Sons.</i>8. <i>Castellan, G. (1983), Physical Chemistry, 3rd ed., Addison Wesley.</i>9. <i>Levine, I.N. (1978), Physical Chemistry, McGraw Hill.</i>10. <i>Maron, S.H. & Lando, J.B. (1974), Fundamentals of Physical Chemistry, McMillan.</i> |
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Bachelor of Chemistry
MODULE HANDBOOK

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Module designation	Physical Chemistry Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133316
Semester(s) in which the module is taught	<i>2nd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia / English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, project based learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry and Mathematics for Chemists</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this Practicum, students are able to:</i></p> <ul style="list-style-type: none"> <i>• Explain the equations of state for ideal and real gases.</i> <i>• Understand the basic concepts and laws of thermodynamics.</i> <i>• Apply the First and Second Laws of Thermodynamics in chemical systems.</i> <i>• Explain thermodynamic functions (internal energy, enthalpy, entropy, Gibbs and Helmholtz free energy).</i>

	<ul style="list-style-type: none"> Evaluate the spontaneity of reactions based on free energy and entropy changes.
Content	<p>This practicum covers:</p> <ol style="list-style-type: none"> Gas equations (ideal and real gases). Concepts and laws of thermodynamics. First Law of Thermodynamics and related concepts (internal energy, enthalpy, thermochemistry). Second Law of Thermodynamics, entropy, and spontaneity. Gibbs and Helmholtz free energies and their applications.
Examination forms	Written exams (mid-term and final), practicum report, individual and group assignments, reports, and project-based assessments.
Study and examination requirements	<p>To successfully pass the module, students must:</p> <ul style="list-style-type: none"> Attend at least 80% of practicum sessions Complete all assignments and project reports Pass mid-term and final examinations Achieve a minimum grade of C
Reading list	<ol style="list-style-type: none"> Rampe, M., (2024). Carbon Quantum Dots. Penerbit NEM Rampe, M., et al., (2025). Surface Structure and chemical composition of coconut shell charcoal using Nira Aren (<i>Arenga pinnata</i>) acid activation. <i>Journal of Chemical Technology and Metallurgy</i> 60 (2), 269-274 Rampe, M., et al., (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih Dan Arang Tempurung Kelapa. <i>Fullerene Journal of Chemistry</i> 9 (1), 21-25 Rampe, M. et al., (2022). Sifat Fisik Arang Tempurung Kelapa: Analisis FTIR, SEM-EDS, dan TG-DTA. Penerbit NEM Ijang Rohman & Sri Mulyani (2000), <i>Physical Chemistry I</i>. Atkins, P.W. (1986), <i>Physical Chemistry</i>, W.H. Freeman & Co. Alberty, R.A. (1987), <i>Physical Chemistry</i>, John Wiley & Sons. Castellan, G. (1983), <i>Physical Chemistry</i>, 3rd ed., Addison Wesley. Levine, I.N. (1978), <i>Physical Chemistry</i>, McGraw Hill. Maron, S.H. & Lando, J.B. (1974), <i>Fundamentals of Physical Chemistry</i>, McMillan.

Module Handbook Bachelor of Chemistry 3rd Semester

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemical Structure and bonding
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133433
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia / English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, project based learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand atomic structure, quantum mechanics basics, and electron configurations.</i> • <i>Explain chemical bonding theories (ionic, covalent, metallic, hydrogen bonding, van der Waals forces).</i> • <i>Describe molecular orbital theory and hybridization.</i>

	<p><i>Skills</i></p> <ul style="list-style-type: none"> • Predict molecular geometry using VSEPR theory. • Analyze bond strength, polarity, and intermolecular interactions. • Apply spectroscopic methods (IR, UV-Vis, NMR) to study bonding and structure. <p><i>Competences</i></p> <ul style="list-style-type: none"> • Integrate bonding theories with experimental data. • Evaluate chemical properties based on structure and bonding. • Communicate scientific reasoning clearly in written and oral formats.
Content	<ol style="list-style-type: none"> 1. Atomic structure and quantum theory 2. Electron configuration and periodic properties 3. Ionic and covalent bonding 4. Metallic bonding and band theory 5. Molecular orbital theory and hybridization 6. VSEPR theory and molecular geometry 7. Intermolecular forces: hydrogen bonding, dipole interactions, van der Waals forces 8. Bond energy, bond length, and bond polarity
Examination forms	Written exams (mid-term and final), oral presentations, individual and group assignments, reports, and project-based assessments.
Study and examination requirements	<p>To successfully pass the module, students must:</p> <ul style="list-style-type: none"> • Attend at least 80% of lectures. • Complete all assignments and project reports. • Pass mid-term and final examinations with a minimum C grade.
Reading list	<ol style="list-style-type: none"> 1. Atkins, P. & de Paula, J. (2022). <i>Physical Chemistry</i>. Oxford University Press. 2. Housecroft, C.E. & Sharpe, A.G. (2018). <i>Inorganic Chemistry</i>. Pearson. 3. McQuarrie, D.A. & Simon, J.D. (1997). <i>Physical Chemistry: A Molecular Approach</i>. University Science Books. 4. Huheey, J.E., Keiter, E.A., & Keiter, R.L. (1997). <i>Inorganic Chemistry: Principles of Structure and Reactivity</i>. HarperCollins.

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| | <p>5. <i>Petrucci, R.H., Herring, F.G., Madura, J.D., & Bissonnette, C. (2017). General Chemistry: Principles and Modern Applications. Pearson.</i></p> |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Polyfunctional Organic Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30123323
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Dr. Rymond Rumampuk, M.Si</i>
Lecturer	<i>Dr. Emma J. Pongoh, M.Si; Dr. Rymond Rumampuk, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Monofunctional Organic Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the structure, nomenclature, and classification of polyfunctional organic compounds (hydroxy acids, amino acids, keto-alcohols, dicarboxylic acids, etc.). • Explain physical and chemical properties influenced by multiple functional groups. • Describe reaction mechanisms in polyfunctional systems (condensation, esterification, amidation, cross-functional reactivity). <p>Skills</p>

	<ul style="list-style-type: none"> Analyze reaction pathways and predict products of polyfunctional organic reactions. Apply spectroscopic methods (IR, NMR, MS) to identify and characterize compounds with multiple functional groups. Design synthetic routes for polyfunctional compounds using protecting groups and selective transformations. <p>Competences</p> <ul style="list-style-type: none"> Integrate theoretical knowledge with laboratory practice in handling complex organic molecules. Evaluate chemoselectivity, regioselectivity, and stereoselectivity in polyfunctional systems. Demonstrate scientific reasoning, ethical awareness, and accuracy in reporting experimental results.
Content	<ol style="list-style-type: none"> Introduction to polyfunctional organic compounds Hydroxycarbonyl compounds (hydroxy acids, keto-alcohols) Amino-carbonyl compounds (amino acids, amides, peptides overview) Dicarboxylic acids and derivatives Polyfunctional aromatic compounds (phenolic acids, amino-phenols, nitro-aromatics) Sulfur- and phosphorus-containing polyfunctional compounds
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<p>Main Reference:</p> <ol style="list-style-type: none"> Pongoh, E.J., Rumampuk, R.J., Tarigan, P., Herlt, A.J., & Mander, L.N. (2002). Two Major Saponins from Seeds of <i>Barringtonia asiatica</i>: Putative Antifeedants toward <i>Epilachna</i> sp. Larvae. <i>Journal of Natural Products</i>, 65(2), 115-120. Pongoh, E.J., Rumampuk, R.J., Tarigan, P. (2010). A Triterpene Ester Saponin from the Seed of <i>Barringtonia asiatica</i>. <i>Indonesian Journal of Chemistry</i>, 3(3), 149-155.

3. **Rumampuk, R.J.,** Safitri, R., Tarigan, P., Freisleben, H.J., Murakami, A. (2003). *Antioxidant Activity in vitro of Two Aromatic Compounds from Caesalpinia sappan L.* *Biofactors*, 19(1-2), 71-77.
4. **Rumampuk, R.J.,** Jenie, U.A., Kardono, L.B.S., Hanafi, M., Darmawan, A. (2014). *Teknik Modern Spektroskopi NMR: Teori dan Aplikasi dalam Elusidasi Struktur Molekul Organik.* LIPI Press.
5. **Pongoh, E.J., Rumampuk, R.J.,** Howan, D., Tamunu, V. (2019). *Skrining Fitokimia dan Potensi Antilitiasis dari Ekstrak Etanol Daun Nusa Indah Putih (Mussaenda pubescens).* *Fullerene Journal of Chemistry*, 4(2), 76-81.
6. **Rumampuk, R.J.,** Mamujaja, M.N., Herlina, T., Maksum, I.P., Rukayadi, Y. (2024). *Flavonoids from Clerodendrum Genus and Their Biological Activities.* *ADMET and DMPK*, 12(6), 843-879
7. Solomons, T.W.G., Fryhle, C.B., & Snyder, S.A. (2020). *Organic Chemistry.* Wiley.
8. McMurry, J. (2021). *Organic Chemistry.* Cengage Learning.
9. Carey, F.A. & Giuliano, R.M. (2016). *Organic Chemistry.* McGraw-Hill.
10. Smith, J.G. (2023). *Organic Chemistry: A Mechanistic Approach.* Oxford University Press.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Polyfunctional Organic Chemistry Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30121322
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Dr. Rymond Rumampuk, M.Si</i>
Lecturer	<i>Dr. Emma J. Pongoh, M.Si; Dr. Rymond Rumampuk, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program; belongs to the Inorganic Chemistry expertise group</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, projectbased learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Monofunctional Organic Chemistry Practicum</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand structure, nomenclature, properties, and reactions of polyfunctional organic compounds (hydroxy acids, amino acids, keto-alcohols, dicarboxylic acids, etc.). • Explain key reaction mechanisms in polyfunctional systems (condensation, esterification, amidation, cross-functional reactivity). <p>Skills</p> <ul style="list-style-type: none"> • Predict reaction products and analyze pathways

	<p>involving multiple functional groups.</p> <ul style="list-style-type: none"> • Design synthetic routes for polyfunctional compounds using protecting groups and selective transformations. <p>Competences</p> <ul style="list-style-type: none"> • Apply theory in laboratory practice for complex organic molecules. • Evaluate chemoselectivity, regioselectivity, and stereoselectivity. • Report results with accuracy, ethical awareness, and sustainability considerations.
Content	<p><i>This practicum covers:</i></p> <ol style="list-style-type: none"> 1. Hydroxycarbonyl compounds (hydroxy acids, keto-alcohols) 2. Amino-carbonyl compounds (amino acids, amides, peptide overview) 3. Dicarboxylic acids and derivatives 4. Polyfunctional aromatic compounds (phenolic acids, amino-phenols, nitro-aromatics) 5. Sulfur- and phosphorus-containing polyfunctional compounds 6. Reaction mechanisms: chemoselectivity, regioselectivity, stereoselectivity
Examination forms	<p><i>Written exams (mid-term and final), practicum report, individual and group assignments, reports, and project-based assessments.</i></p>
Study and examination requirements	<p><i>To successfully pass the module, students must:</i></p> <ul style="list-style-type: none"> • <i>Attend at least 80% of practicum sessions</i> • <i>Complete all assignments and project reports</i> • <i>Pass mid-term and final examinations</i> • <i>Achieve a minimum grade of C</i>
Reading list	<p><i>Main Reference:</i></p> <ol style="list-style-type: none"> 1. Pongoh, E.J., Rumampuk, R.J., Tarigan, P., Herlt, A.J., & Mander, L.N. (2002). Two Major Saponins from Seeds of <i>Barringtonia asiatica</i>: Putative Antifeedants toward <i>Epilachna</i> sp. Larvae. <i>Journal of Natural Products</i>, 65(2), 115-120. 2. Pongoh, E.J., Rumampuk, R.J., Tarigan, P. (2010). A Triterpene Ester Saponin from the Seed of <i>Barringtonia asiatica</i>. <i>Indonesian Journal of Chemistry</i>, 3(3), 149-155. 3. Rumampuk, R.J., Safitri, R., Tarigan, P.,

	<p>Freisleben, H.J., Murakami, A. (2003). Antioxidant Activity in vitro of Two Aromatic Compounds from <i>Caesalpinia sappan</i> L. <i>Biofactors</i>, 19(1-2), 71-77.</p> <p>4. Rumampuk, R.J., Jenie, U.A., Kardono, L.B.S., Hanafi, M., Darmawan, A. (2014). <i>Teknik Modern Spektroskopi NMR: Teori dan Aplikasi dalam Elusidasi Struktur Molekul Organik</i>. LIPI Press.</p> <p>5. Pongoh, E.J., Rumampuk, R.J., Howan, D., Tamunu, V. (2019). <i>Skrining Fitokimia dan Potensi Antilitiasis dari Ekstrak Etanol Daun Nusa Indah Putih (<i>Mussaenda pubescens</i>)</i>. <i>Fullerene Journal of Chemistry</i>, 4(2), 76-81.</p> <p>6. Rumampuk, R.J., Mamuaja, M.N., Herlina, T., Maksun, I.P., Rukayadi, Y. (2024). <i>Flavonoids from Clerodendrum Genus and Their Biological Activities</i>. <i>ADMET and DMPK</i>, 12(6), 843-879</p> <p>7. Solomons, T.W.G., Fryhle, C.B., & Snyder, S.A. (2020). <i>Organic Chemistry</i>. Wiley.</p> <p>8. McMurry, J. (2021). <i>Organic Chemistry</i>. Cengage Learning.</p> <p>9. Carey, F.A. & Giuliano, R.M. (2016). <i>Organic Chemistry</i>. McGraw-Hill.</p> <p>10. Smith, J.G. (2023). <i>Organic Chemistry: A Mechanistic Approach</i>. Oxford University Press.</p>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Inorganic Metal Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133325
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Aisyiah R.P. Utami, M.Sc.; Joice D. Caroles, M.Si; Prof. Dr. Meytij Rampe, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program; belongs to the Inorganic Chemistry expertise group</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Inorganic Non-Metal Chemistry</i>
Module objectives/intended learning outcomes	<p><i>After completing this course, students are expected to:</i></p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand the structure, characteristics, reactivity, and synthesis of s-, d-, and f-block metal elements and compounds.</i> • <i>Explain coordination chemistry, crystal field theory, and bonding in metal complexes.</i> • <i>Describe periodic trends and their influence on metal reactivity.</i> <p><i>Skills</i></p>

	<ul style="list-style-type: none"> Analyze chemical properties and synthesize various metal compounds based on experimental data and case studies. Apply spectroscopic and analytical methods (UV-Vis, IR, XRD, AAS) to characterize metal complexes. Design experiments to study reactivity and catalytic behavior of transition metals. <p>Competences</p> <ul style="list-style-type: none"> Apply theoretical concepts of Inorganic Chemistry II to practical and real-life cases. Make sound scientific judgments in problem-solving through practice-oriented activities. Demonstrate ethical awareness and accuracy in reporting laboratory results.
Content	<ul style="list-style-type: none"> Structure and characteristics of s-, d-, and f-block metal elements and compounds Reactivity and synthesis of alkali, alkaline earth, transition, and inner transition metals Coordination chemistry: ligands, complexes, and stability constants Crystal field theory and electronic spectra of transition metal complexes Organometallic chemistry and catalysis Case studies of metal compound applications (e.g., catalysts, alloys, pigments, superconductors, biominerals)
Examination forms	Mid-term and final written exams, individual/group assignments, Practicum report
Study and examination requirements	<ul style="list-style-type: none"> Attendance $\geq 8\%$ Active participation in discussion and presentation Completion of all assignments and quizzes Mid-term exam (UTS) and final exam (UAS) Passing grade: minimum C
Reading list	<p>Main Reference:</p> <ol style="list-style-type: none"> Meisler, G.I., & Tarr, D.A. (1991). <i>Inorganic Chemistry</i>. New Jersey: Prentice Hall. Brown, T.L., & Bursten, B.E. (2009). <i>Chemistry: The Central Science (11th Ed.)</i>. Upper Saddle River, NJ: Pearson Prentice Hall. Rampe, M., (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM Effendy. (2008). <i>VSEPR Theory, Polarity and Intermolecular Forces (2nd Ed.)</i>. Malang: Bayumedia Publishing. Rampe, M., et al., (2025). <i>Surface Structure and chemical composition of coconut shell charcoal using</i>

Nira Aren (*Arenga pinnata*) acid activation. *Journal of Chemical Technology and Metallurgy* 60 (2), 269-274
6. **Rampe, M.**, et al., (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih Dan Arang Tempurung Kelapa. *Fullerene Journal of Chemistry* 9 (1), 21-25
7. Rampe, M. et al., (2022). *Sifat Fisik Arang Tempurung Kelapa: Analisis FTIR, SEM-EDS, dan TG-DTA*. Penerbit NEM

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

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Module designation	Inorganic Metal Chemistry Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131324
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Aisyiah R.P. Utami, M.Sc.; Joice D. Caroles, M.Si; Prof. Dr. Meytij Rampe, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program; belongs to the Inorganic Chemistry expertise group</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, projectbased learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Inorganic Non-Metal Chemistry Practicum</i>
Module objectives/intended learning outcomes	<p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand the structure, bonding, and reactivity of s-, d-, and f-block metal compounds.</i> • <i>Explain coordination chemistry principles and crystal field effects in metal complexes.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> • <i>Synthesize and characterize simple metal salts and complexes.</i> • <i>Apply spectroscopic and analytical methods (UV-Vis, IR, AAS, XRD) to study metal compounds.</i>

	<ul style="list-style-type: none"> Evaluate catalytic and redox properties of transition metals. <p>Competences</p> <ul style="list-style-type: none"> Integrate theoretical concepts with laboratory practice in inorganic metal chemistry. Demonstrate accuracy, safety, and ethical awareness in handling metal compounds. Report and interpret experimental results with scientific reasoning
Content	<p>This practicum covers:</p> <ol style="list-style-type: none"> Preparation and properties of alkali and alkaline earth metal salts Synthesis and characterization of transition metal complexes Crystal field stabilization and electronic spectra of metal complexes Redox reactions of transition metals Catalytic activity of selected metal compounds
Examination forms	<p>Written exams (mid-term and final), practicum report, individual and group assignments, reports, and project-based assessments.</p>
Study and examination requirements	<p>To successfully pass the module, students must:</p> <ul style="list-style-type: none"> Attend at least 80% of practicum sessions Complete all assignments and project reports Pass mid-term and final examinations Achieve a minimum grade of C
Reading list	<p>Main Reference:</p> <ol style="list-style-type: none"> Meisler, G.I., & Tarr, D.A. (1991). <i>Inorganic Chemistry</i>. New Jersey: Prentice Hall. Brown, T.L., & Bursten, B.E. (2009). <i>Chemistry: The Central Science</i> (11th Ed.). Upper Saddle River, NJ: Pearson Prentice Hall. Rampe, M., (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM Effendy. (2008). <i>VSEPR Theory, Polarity and Intermolecular Forces</i> (2nd Ed.). Malang: Bayumedia Publishing. Rampe, M., et al., (2025). Surface Structure and chemical composition of coconut shell charcoal using Nira Aren (<i>Arenga pinnata</i>) acid activation. <i>Journal of Chemical Technology and Metallurgy</i> 60 (2), 269-274 Rampe, M., et al., (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih Dan Arang Tempurung Kelapa. <i>Fullerene Journal of Chemistry</i> 9 (1), 21-25 Rampe, M. et al., (2022). <i>Sifat Fisik Arang Tempurung</i>

	<p><i>Kelapa: Analisis FTIR, SEM-EDS, dan TG-DTA. Penerbit NEM</i></p>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemical Kinetics
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133327
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Dr. Johnny Z. Lombok, M.Si. Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia / English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, projectbased learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Physical Chemistry</i>

<p>Module objectives/intended learning outcomes</p>	<p>Knowledge</p> <ul style="list-style-type: none"> Understand rate laws, reaction order, and integrated rate equations. Explain collision theory, transition state theory, and reaction mechanisms. Describe thermodynamic functions (internal energy, enthalpy, entropy, Gibbs and Helmholtz free energy) and their relation to kinetics. <p>Skills</p> <ul style="list-style-type: none"> Analyze experimental kinetic data and determine rate constants. Apply mathematical models to evaluate reaction mechanisms. Use computational and spectroscopic methods to study reaction progress. <p>Competences</p> <ul style="list-style-type: none"> Integrate kinetic and thermodynamic concepts in chemical system analysis. Evaluate spontaneity and feasibility of reactions based on free energy and entropy changes. Demonstrate scientific reasoning, ethical awareness, and accuracy in reporting results.
<p>Content</p>	<p>This course covers:</p> <ol style="list-style-type: none"> Fundamentals of chemical kinetics: rate laws, reaction order, integrated equations Collision theory and transition state theory Reaction mechanisms and catalysis Experimental methods in kinetics (spectroscopy, calorimetry) Case studies: kinetics in industrial and biological systems
<p>Examination forms</p>	<p>Written exams (mid-term and final), oral presentations, individual and group assignments, reports, and project-based assessments.</p>
<p>Study and examination requirements</p>	<p>To successfully pass the module, students must:</p> <ul style="list-style-type: none"> Attend at least 80% of lectures. Complete all assignments and project reports. Pass mid-term and final examinations with a minimum cumulative score C.

Reading list	<ol style="list-style-type: none"> 1. Atkins, P.W. & de Paula, J. (2022). <i>Physical Chemistry</i>. Oxford University Press. 2. Levine, I.N. (2014). <i>Physical Chemistry</i>. McGraw-Hill. 3. Alberty, R.A. (1987). <i>Physical Chemistry</i>. Wiley. 4. Castellan, G. (1983). <i>Physical Chemistry</i>, 3rd ed. Addison Wesley. 5. Maron, S.H. & Lando, J.B. (1974). <i>Fundamentals of Physical Chemistry</i>. McMillan. 6. Ijang Rohman & Sri Mulyani (2000). <i>Physical Chemistry I</i>. 7. Rampe, M.J. & Tiwow, V.A. (2025). <i>Reaksi Sederhana dan Reaksi Rumit</i>. Penerbit NEM. 8. Rampe, M.J. (2025). <i>Arang Tempurung Kelapa: Sifat-sifat dan Aplikasi</i>. Penerbit NEM. 9. Rampe, M.J. (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM. 10. Rampe, M.J. & Lombok, J.Z. (2024). <i>Kimia Material</i>. Penerbit NEM. 11. Rampe, M.J. (2023). <i>Kimia Fisik (Jilid 1)</i>. Penerbit NEM. 12. Rampe, M.J. et al. (2025). <i>Surface Structure and Chemical Composition of Coconut Shell Charcoal Using Nira Aren Acid Activation</i>. <i>Journal of Chemical Technology and Metallurgy</i>, 60(2), 269-274.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

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Module designation	Chemical Kinetics Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131326
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia / English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, projectbased learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Physical Chemistry Practicum</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this Practicum, students are able to:</i></p> <p>Knowledge</p> <ul style="list-style-type: none"> <i>Understand rate laws, reaction order, and integrated rate equations.</i> <i>Explain collision theory, transition state theory, and catalysis in practice.</i> <p>Skills</p> <ul style="list-style-type: none"> <i>Measure reaction rates experimentally (e.g., iodine clock, acid-base neutralization, enzyme kinetics).</i> <i>Analyze kinetic data to determine rate constants</i>

	<p>and activation energy.</p> <ul style="list-style-type: none"> Apply spectroscopic and computational methods to study reaction progress. <p>Competences</p> <ul style="list-style-type: none"> Integrate kinetic theory with laboratory practice. Evaluate reaction mechanisms and catalytic efficiency. Report results with accuracy, ethical awareness, and sustainability considerations.
Content	<p>This practicum covers:</p> <ol style="list-style-type: none"> Determination of reaction order (e.g., decomposition of hydrogen peroxide). Integrated rate laws and half-life measurements. Iodine clock reaction: kinetics of oxidation-reduction. Temperature dependence of reaction rates (Arrhenius equation). Catalysis in chemical kinetics (heterogeneous and homogeneous). Enzyme kinetics and Michaelis-Menten analysis. Spectroscopic monitoring of reaction progress (UV-Vis, IR). Case studies: kinetics in industrial and biological systems.
Examination forms	<p>Written exams (mid-term and final), practicum report, individual and group assignments, reports, and project-based assessments.</p>
Study and examination requirements	<p>To successfully pass the module, students must:</p> <ul style="list-style-type: none"> Attend at least 80% of practicum sessions Complete all assignments and project reports Pass mid-term and final examinations Achieve a minimum grade of C
Reading list	<ol style="list-style-type: none"> Atkins, P.W. & de Paula, J. (2022). <i>Physical Chemistry</i>. Oxford University Press. Levine, I.N. (2014). <i>Physical Chemistry</i>. McGraw-Hill. Alberty, R.A. (1987). <i>Physical Chemistry</i>. Wiley. Castellan, G. (1983). <i>Physical Chemistry</i>, 3rd ed. Addison Wesley. Maron, S.H. & Lando, J.B. (1974). <i>Fundamentals of Physical Chemistry</i>. McMillan. Ijang Rohman & Sri Mulyani (2000). <i>Physical Chemistry I</i>.

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| | <ol style="list-style-type: none">7. Rampe, M.J. & Tiwow, V.A. (2025). <i>Reaksi Sederhana dan Reaksi Rumit</i>. Penerbit NEM.8. Rampe, M.J. (2025). <i>Arang Tempurung Kelapa: Sifat-sifat dan Aplikasi</i>. Penerbit NEM.9. Rampe, M.J. (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM.10. Rampe, M.J. & Lombok, J.Z. (2024). <i>Kimia Material</i>. Penerbit NEM.11. Rampe, M.J. (2023). <i>Kimia Fisik (Jilid 1)</i>. Penerbit NEM.11. Rampe, M.J. et al. (2025). <i>Surface Structure and Chemical Composition of Coconut Shell Charcoal Using Nira Aren Acid Activation</i>. <i>Journal of Chemical Technology and Metallurgy</i>, 60(2), 269-274. |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemical Separation
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133329
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si.</i>
Lecturer	<i>Abdon Saiya, M.Si. Vlagia I. Paat, M.Si. Dr. Anderson Aloanis, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, collaborative learning, and project-based learning.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Fundamental of Analytical chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this module, students are able to:</i></p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand principles of separation techniques (distillation, extraction, chromatography, electrophoresis, membrane separation).</i> • <i>Explain theoretical foundations of separation efficiency, selectivity, and resolution.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> • <i>Apply chromatographic methods (TLC, HPLC,</i>

	<p>GC) for compound separation.</p> <ul style="list-style-type: none"> • Use spectroscopic and analytical tools to validate separation results. • Design separation strategies for complex mixtures in food, environmental, and pharmaceutical contexts. <p>Competences</p> <ul style="list-style-type: none"> • Integrate separation techniques into problem-solving in chemical analysis. • Demonstrate accuracy, safety, and ethical awareness in laboratory separation practices. • Communicate results effectively in scientific reports and presentations
Content	<p>This course covers:</p> <ol style="list-style-type: none"> 1. Principles of separation science 2. Distillation and solvent extraction 3. Chromatography (TLC, column, HPLC, GC) 4. Electrophoresis and ion-exchange separation 5. Membrane separation and dialysis 6. Case studies: pesticide residue analysis, heavy metal detection, bioactive compound isolation 7. Validation of separation methods (precision, accuracy, reproducibility) 8. Applications in food chemistry, environmental monitoring, and pharmaceuticals
Examination forms	<p>Written examinations (mid-term and final), assignments, discussions, and analytical calculation exercises.</p>
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> • Attendance $\geq 80\%$ • Completion of all assignments and project reports • Pass mid-term and final examinations with a minimum grade of
Reading list	<ol style="list-style-type: none"> 1. Paat, V.I., Aloanis, A.A., Rumampuk, R.J. (2025). <i>Kimia Analitik Lanjut</i>. Penerbit Tahta Media. 2. Paat, V.I., Aloanis, A.A. (2025). <i>Buku Ajar Elektrokimia</i>. Penerbit Tahta Media. 3. Saiya, A. (2017). Analisis Residu Klorpirifos dalam Sayuran Kubis dengan HPLC. <i>Eksakta: Berkala Ilmiah Bidang MIPA</i>, 18(2), 77-85. 4. Saiya, A., Gumolung, D., Caroles, J.D.S. (2018).

	<p><i>Analisis Residu Pestisida dalam Tomat, Cabai Rawit dan Wortel. Fullerene Journal of Chemistry, 3(2), 63-69.</i></p> <ol style="list-style-type: none">5. Saiya, A., Caroles, J. (2023). <i>Validasi Metode Analisis Beta Karoten dengan KCKT. Fullerene Journal of Chemistry, 7(1), 8-12.</i>6. Skoog, D.A., Holler, F.J., & Crouch, S.R. (2018). <i>Principles of Instrumental Analysis. Cengage Learning.</i>7. Harris, D.C. (2020). <i>Quantitative Chemical Analysis. W.H. Freeman.</i>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemical Separation Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131218
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si.</i>
Lecturer	<i>Abdon Saiya, M.Si; Vlagia I. Paat, M.Si; Dr. Anderson A. Aloanis, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Laboratory experiments, discussions, report writing, project-based and collaborative learning.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this module, students are able to:</i></p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand principles of chemical separation (distillation, extraction, chromatography, electrophoresis, membrane separation).</i> • <i>Explain theoretical foundations of separation efficiency, selectivity, and resolution.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> • <i>Perform chromatographic separations (TLC,</i>

	<p>HPLC, GC) and validate results.</p> <ul style="list-style-type: none"> Apply spectroscopic and analytical tools to confirm separation outcomes. Design separation strategies for complex mixtures in food, environmental, and pharmaceutical contexts. <p>Competences</p> <ul style="list-style-type: none"> Integrate separation techniques into problem-solving in chemical analysis. Demonstrate accuracy, safety, and ethical awareness in laboratory separation practices. Communicate results effectively in scientific reports and presentations.
Content	<p>The course includes practical work on:</p> <ol style="list-style-type: none"> Distillation and solvent extraction experiments Thin-layer chromatography (TLC) for organic mixtures Column chromatography for natural product isolation High-performance liquid chromatography (HPLC) for pesticide residue analysis Gas chromatography (GC) for volatile compounds Electrophoresis for biomolecule separation Membrane separation and dialysis Case studies: food chemistry, environmental monitoring, pharmaceutical analysis
Examination forms	<p>Practical performance assessment, written report, oral presentation, mid-term and final exams.</p>
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> Attend at least 80% of practical sessions. Complete and submit all practical reports. Pass mid-term and final evaluations. Demonstrate proper laboratory conduct and safety compliance.
Reading list	<ol style="list-style-type: none"> Saiya, A. (2017). Analisis Residu Klorpirifos dalam Sayuran Kubis dengan HPLC. Eksakta: Berkala Ilmiah Bidang MIPA, 18(2), 77-85. Saiya, A., Gumolung, D., Caroles, J.D.S. (2018). Analisis Residu Pestisida dalam Tomat, Cabai Rawit dan Wortel. Fullerene Journal of Chemistry, 3(2), 63-69. Saiya, A., Caroles, J. (2023). Validasi Metode

	<p><i>Analisis Beta Karoten dengan KCKT. Fullerene Journal of Chemistry, 7(1), 8-12.</i></p> <ol style="list-style-type: none">4. Paat, V.I., Aloanis, A.A. (2025). <i>Kimia Analitik Lanjut. Penerbit Tahta Media.</i>5. Paat, V.I., Aloanis, A.A. (2025). <i>Buku Ajar Elektrokimia. Penerbit Tahta Media.</i>6. Skoog, D.A., Holler, F.J., & Crouch, S.R. (2018). <i>Principles of Instrumental Analysis. Cengage Learning</i>7. Harris, D.C. (2020). <i>Quantitative Chemical Analysis. W.H. Freeman</i>8. Poole, C.F. (2019). <i>Chromatography Today. Elsevier.</i>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Structure and Function of Biomolecules
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131331
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Feti Fatimah, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si, Septiany Palilingan, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, collaborative learning, and project-based learning.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this module, students are able to:</i></p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand the structure and function of biomolecules (proteins, carbohydrates, lipids, nucleic acids).</i> • <i>Explain biochemical interactions and their role in metabolism and cellular processes.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> • <i>Analyze biomolecular structures using spectroscopic and chromatographic methods.</i>

	<ul style="list-style-type: none"> • Perform enzyme kinetics and protein characterization. • Apply biochemical principles to food chemistry, health, and biotechnology. <p>Competences</p> <ul style="list-style-type: none"> • Integrate theoretical biochemistry with practical applications. • Demonstrate accuracy, safety, and ethical awareness in biomolecular studies. • Communicate scientific findings effectively in reports and presentations.
Content	<p><i>This course covers:</i></p> <ol style="list-style-type: none"> 1. Introduction to biomolecules and their chemical properties 2. Structure and function of proteins (primary to quaternary) 3. Carbohydrates: monosaccharides, polysaccharides, and glycosidic linkages 4. Lipids: fatty acids, triglycerides, phospholipids, and sterols 5. Nucleic acids: DNA, RNA, and their role in genetic information 6. Enzyme structure, function, and kinetics 7. Biomolecular interactions and metabolic pathways 8. Case studies: biomolecules in food chemistry, health, and biotechnology
Examination forms	Written examinations (mid-term and final), assignments, discussions, and analytical calculation exercises.
Study and examination requirements	<p><i>To pass the module, students must:</i></p> <ul style="list-style-type: none"> • Attend at least 80% of lectures • Complete all assignments and project reports • Pass mid-term and final examinations • Achieve a minimum grade of C
Reading list	<ol style="list-style-type: none"> 1. Fatimah, F., Gugule, S., Maanari, C.P., Setyawati, I., Utami, A.R.P. (2024). Optimization, Characterization and Antioxidant Activity of Fish Protein Hydrolysate from Payangka (<i>Ophieleotris aporos</i>) using Papain and Bromelain. <i>Pakistan Journal of Biological Sciences</i>, 29(2), 92-101. 2. Lestari, E.P., Gugule, S., Fatimah, F., Maanari, C. (2024). Pengaruh Proses Pembuatan Terhadap Karakteristik Minyak Kelapa. <i>Jurnal FisTa: Fisika dan</i>

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| | <p><i>Terapannya</i>, 6(2), 75-81.</p> <ol style="list-style-type: none">3. Iskandar, A., Fatimah, F., Aloanis, A. (2024). <i>Physicochemical Properties of Rice Fortified with Payangka Fish Protein Hydrolysate</i>. <i>Fullerene Journal of Chemistry</i>, 10(2), 65-714. Nelson, D.L. & Cox, M.M. (2021). <i>Lehninger Principles of Biochemistry</i>. W.H. Freeman.5. Berg, J.M., Tymoczko, J.L., & Gatto, G.J. (2019). <i>Biochemistry</i>. W.H. Freeman.6. Voet, D. & Voet, J.G. (2018). <i>Biochemistry</i>. Wiley.Stryer, L. (2015). <i>Biochemistry</i>. W.H. Freeman. |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Practicum on Structure and Function of Biomolecules
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131330
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Feti Fatimah, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si, Septiany Palilingan, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Laboratory experiments, discussions, report writing, project-based and collaborative learning.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this Practicum, students are able to:</i></p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> <i>• Understand the structure and function of biomolecules (proteins, carbohydrates, lipids, nucleic acids).</i> <i>• Explain biochemical interactions and their role in metabolism and cellular processes.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> <i>• Perform qualitative and quantitative analysis of biomolecules.</i> <i>• Apply spectroscopic and chromatographic methods to study biomolecular structure.</i>

	<ul style="list-style-type: none"> • Conduct enzyme assays and protein characterization experiments. <p>Competences</p> <ul style="list-style-type: none"> • Integrate theoretical biochemistry with laboratory practice. • Demonstrate accuracy, safety, and ethical awareness in biomolecular experiments. • Communicate scientific findings effectively in reports and presentations.
Content	<p>The course includes practical work on:</p> <ol style="list-style-type: none"> 1. Isolation and characterization of proteins (e.g., albumin, casein). 2. Carbohydrate analysis (reducing sugars, starch hydrolysis). 3. Lipid extraction and saponification. 4. Nucleic acid isolation and spectrophotometric quantification. 5. Enzyme kinetics (Michaelis-Menten analysis). 6. Chromatographic separation of amino acids and sugars. 7. Case studies: biomolecules in food chemistry and health applications.
Examination forms	<p>Practical performance assessment, written report, oral presentation, mid-term and final exams.</p>
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> • Attend at least 80% of practical sessions. • Complete and submit all practical reports. • Pass mid-term and final evaluations. • Demonstrate proper laboratory conduct and safety compliance.
Reading list	<ol style="list-style-type: none"> 7. Fatimah, F., Gugule, S., Maanari, C.P., Setyawati, I., Utami, A.R.P. (2024). Optimization, Characterization and Antioxidant Activity of Fish Protein Hydrolysate from Payangka (<i>Ophieleotris aporos</i>) using Papain and Bromelain. <i>Pakistan Journal of Biological Sciences</i>, 29(2), 92-101. 8. Lestari, E.P., Gugule, S., Fatimah, F., Maanari, C. (2024). Pengaruh Proses Pembuatan Terhadap Karakteristik Minyak Kelapa. <i>Jurnal FisTa: Fisika dan Terapannya</i>, 6(2), 75-81. 9. Iskandar, A., Fatimah, F., Aloanis, A. (2024). Physicochemical Properties of Rice Fortified with Payangka Fish Protein Hydrolysate. <i>Fullerene Journal of Chemistry</i>, 10(2), 65-71 10. Nelson, D.L. & Cox, M.M. (2021). <i>Lehninger</i>

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| | <p><i>Principles of Biochemistry. W.H. Freeman.</i></p> <ol style="list-style-type: none">11. Berg, J.M., Tymoczko, J.L., & Gatto, G.J. (2019). <i>Biochemistry. W.H. Freeman.</i>12. Voet, D. & Voet, J.G. (2018). <i>Biochemistry. Wiley.</i>13. Stryer, L. (2015). <i>Biochemistry. W.H. Freeman.</i> |
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Module Handbook

Bachelor of Chemistry

4th Semester

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Statistics Methods
Module level	Bachelor (Undergraduate)
Code	30122332
Semester(s) in which the module is taught	4 th Semester
Person responsible for the module	<i>Dra. Vivian Regar, M.Pd</i>
Lecturer	<i>Dra. Vivian Regar, M.Pd</i>
Language	Indonesian/English
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, Case-Based Learning, Problem-Based Learning, Question- Answer, Discussion, Task-Based Learning, Data Analysis Practice</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Mathematics for chemistry</i>

<p>Module objectives/intended learning outcomes</p>	<p>After completing this module, students are expected to:</p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> • Understand basic concepts of descriptive and inferential statistics. • Explain probability distributions and sampling methods. • Describe hypothesis testing, correlation, and regression analysis. <p><i>Skills</i></p> <ul style="list-style-type: none"> • Apply statistical methods to analyze experimental and educational data. • Use statistical software/tools (e.g., SPSS, R, Excel) for data processing. • Interpret statistical results in scientific and educational contexts. <p><i>Competences</i></p> <ul style="list-style-type: none"> • Integrate statistical reasoning into research and problem-solving. • Evaluate data validity and reliability. • Communicate statistical findings accurately in reports and presentations.
<p>Content</p>	<ol style="list-style-type: none"> 1. Basic concepts of statistics and its scope 2. Data types and research designs 3. Data collection, presentation, distribution, measurement scales 4. Measures of central tendency (mean, median, mode, quartiles, deciles, percentiles) 5. Measures of dispersion (range, interquartile range, variance, standard deviation) 6. Inferential statistics 7. Assumption tests: normality & homogeneity 8. Correlation analysis (bivariate & partial) 9. Regression analysis (simple & multiple) 10. Bivariate comparative analysis (t-test, chi-square) 11. Analysis of variance (ANOVA: one-way & two-way) 12. Path analysis
<p>Examination forms</p>	<p>Quizzes, Assignments (Tugas 1-10), Case Studies, Midterm Exam, Final Exam, Presentation, Data Analysis Project</p>

<p>Study and examination requirements</p>	<ul style="list-style-type: none"> • Attendance and participation • Completion of structured statistical tasks • Data processing assignments (frequency distribution, central tendency, dispersion, inferential tests) • Midterm Exam (concepts, descriptive statistics) • Final Exam (inferential statistics & applied analysis) • Upholding academic integrity and accuracy of data
<p>Reading list</p>	<p>Main References:</p> <ul style="list-style-type: none"> • Sudjana (2002). <i>Metoda Statistika</i>. Tarsito. • Sugiyono (2016). <i>Statistika untuk Penelitian</i>. Alfabeta. • Gunawan, M.A. (2015). <i>Statistik Penelitian Bidang Pendidikan Psikologi Sosial</i>. Parama Publishing. • Hahs-Vaughn & Lomax (2013). <i>An Introduction to Statistical Concepts</i>. Routledge. • Landau & Everitt (2003). <i>A Handbook of Statistical Analyses Using SPSS</i>. Chapman & Hall/CRC. • Leech, Barrett & Morgan (2013). <i>SPSS for Intermediate Statistics</i>. Routledge. • Ott & Longnecker (2015). <i>Statistical Methods and Data Analysis</i>. Nelson Education

Bachelor of Chemistry

MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	English for Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30112210
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Dian Howan, M.Phil, Ph.D</i>
Lecturer	<i>Dr. Rymond Rumampuk, M.Si; Dian Howan, M.Phil, Ph.D</i>
Language	<i>English</i>
Relation to curriculum	<i>Compulsory course in Chemistry Education Study Program</i>
Teaching methods	<i>Flipped classroom, problem-based learning, discussion, individual and group assignments, online and offline learning (LMS UNIMA)</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p><i>After completing this module, students are expected to:</i></p> <p><i>Knowledge: Understand the use of English in chemistry (ESP), grammar, and scientific communication.</i></p> <p><i>Skills: Read, write, listen, and speak effectively in English within the context of chemistry.</i></p> <p><i>Competences: Produce scientific writing, analyze chemical texts, present research orally, and participate in academic discussions in English.</i></p>

Content	<ul style="list-style-type: none"> - <i>Introduction to English for Specific Purposes (ESP) in Chemistry</i> - <i>Grammar in scientific contexts (tenses, parts of speech, sentence structure)</i> - <i>Listening to seminars and lectures in English</i> - <i>Reading scientific journals and books</i> - <i>Writing chemistry papers and reports in English</i> - <i>Speaking and presenting scientific topics in English</i>
Examination forms	<p><i>Written exams (mid-term and final), quizzes, assignments, discussions, project/paper presentation, and class participation</i></p>
Study and examination requirements	<ul style="list-style-type: none"> - <i>Attendance \geq 80%</i> - <i>Completion of all assignments and participation in discussions - Presentation of individual/group projects</i> - <i>Mid-term exam (UTS) and final exam (UAS)</i> - <i>Pass mark: minimum grade C</i>
Reading list	<p><i>Main References:</i></p> <ol style="list-style-type: none"> 1. <i>BožVenerableon. (2009). English for Chemist. Paul Joseph University.</i> 2. <i>Chang, R. (2010). Chemistry (10th Edition). McGraw-Hill: New York.</i> 3. <i>Jespersen, N. D., Brady, J., & Hyslop, A. (2012). Chemistry. John Wiley and Sons, Inc.: New Jersey.</i> <p><i>Supporting References:</i></p> <ol style="list-style-type: none"> 1. <i>International chemistry articles and journals.</i> 2. <i>Lecture and seminar videos.</i>

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Reactivity and Mechanism of Organic Reactions
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133434
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Dr. Rymond Rumampuk, M.Si</i>
Lecturer	<i>Dr. Anderson A. Aloanis, M.Si; Dr. Rymond Rumampuk, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Polyfunctional Organic Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand fundamental principles of organic reactivity and reaction mechanisms. • Explain substitution (SN1, SN2), elimination (E1, E2), addition, oxidation, and reduction mechanisms. • Describe stereoelectronic effects, carbocation stability, and radical mechanisms. <p>Skills</p> <ul style="list-style-type: none"> • Analyze reaction pathways and predict products

	<p>based on mechanistic reasoning.</p> <ul style="list-style-type: none"> • Apply spectroscopic methods (IR, NMR, MS) to support mechanistic studies. • Design synthetic routes considering reactivity and selectivity.
Content	<ol style="list-style-type: none"> 1. Principles of organic reactivity 2. Substitution reactions (SN1, SN2) 3. Elimination reactions (E1, E2) 4. Addition reactions to alkenes and alkynes 5. Aromatic substitution mechanisms (electrophilic and nucleophilic) 6. Radical reactions and polymerization mechanisms 7. Oxidation and reduction in organic chemistry 8. Rearrangement reactions (carbocation shifts, ring expansions) 9. Stereoelectronic effects and stereochemistry in mechanisms 10. Case studies: mechanistic analysis in pharmaceuticals and bioactive compounds
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> 1. Solomons, T.W.G., Fryhle, C.B., & Snyder, S.A. (2020). <i>Organic Chemistry</i>. Wiley. 2. McMurry, J. (2021). <i>Organic Chemistry</i>. Cengage Learning. 3. Carey, F.A. & Giuliano, R.M. (2016). <i>Organic Chemistry</i>. McGraw-Hill. 4. Smith, J.G. (2023). <i>Organic Chemistry: A Mechanistic Approach</i>. Oxford University Press. 5. Aloanis, A.A., Paat, V.I. (2023). <i>Reaksi-Reaksi Senyawa Organik</i>. Penerbit Tahta Media. 6. Gugule, S., Aloanis, A.A. (2023). <i>Mempelajari Reaksi Transesterifikasi Terkatalisis Kalsium Oksida</i>. <i>Fullerene Journal of Chemistry</i>, 5(2), 73-77. 7. Simbolon, H.R.B., Rumampuk, R.J., Aloanis, A.A. (2024). <i>Kajian Regiokimia Markovnikov Melalui Mekanisme Reaksi Hidrasi Alkuna Terminal pada Etinilestradiol dengan Katalis FeCl₃</i>. <i>Fullerene Journal of Chemistry</i>, 6(1), 39-45.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Inorganic Physical Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133435
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si, Miftahul Jannah, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Chemical Kinetics and Inorganic Metal Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the principles of inorganic physical chemistry (thermodynamics, kinetics, quantum chemistry). • Explain bonding theories, electronic structures, and reactivity of inorganic compounds. • Describe physical methods applied to inorganic systems (spectroscopy, electrochemistry). <p>Skills</p> <ul style="list-style-type: none"> • Apply thermodynamic and kinetic models to inorganic reactions.

	<ul style="list-style-type: none"> • Use spectroscopic and computational tools for structural analysis. • Design and interpret experiments involving inorganic physical systems. <p>Competences</p> <ul style="list-style-type: none"> • Integrate inorganic and physical chemistry knowledge in problem-solving. • Demonstrate accuracy, reproducibility, and ethical responsibility in laboratory practice. • • Communicate findings effectively in scientific reports and presentations
Content	<ol style="list-style-type: none"> 1. Introduction to inorganic physical chemistry 2. Thermodynamics of inorganic systems 3. Chemical kinetics and reaction mechanisms 4. Quantum chemistry and electronic structures 5. Bonding theories (MO, crystal field, ligand field) 6. Spectroscopic methods (UV-Vis, IR, Raman, NMR, EPR) 7. Electrochemistry of inorganic compounds
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> 1. Tiwow, V.A., Rampe, M.J., Arsyad, M. (2023). <i>Kajian Suseptibilitas Magnetik Bergantung Frekuensi terhadap Pasir Besi Kabupaten Takalar. Jurnal Sainsmat, 7(2), 136-146.</i> 2. Arsyad, M., Tiwow, V.A., Rampe, M.J. (2018). <i>Analysis of Magnetic Minerals of Iron Sand Deposit in Sampulungan Beach, Takalar Regency, South Sulawesi using the X-ray Diffraction Method. Journal of Physics: Conference Series, 1120(1), 012060.</i> 3. Tiwow, V.A., Arsyad, M., Palloan, P., Rampe, M.J. (2018). <i>Analysis of Mineral Content of Iron Sand Deposit in Bontokanang Village and Tanjung Bayang Beach, South Sulawesi, Indonesia. Journal of Physics: Conference Series, 997(1), 012010.</i> 4. Tiwow, V.A., Subaer, Sulistiawaty, Malago, J.D., Rampe, M.J., Lapa, M. (2021). <i>Magnetic Susceptibility of Surface Sediment in the Tallo Tributary of Makassar City. Journal of Physics:</i>

- Conference Series, 1899(1), 012124.
5. Rampe, M.J., Lombok, J.Z., Tiwow, V.A., Tengker, S.M.T., Bua, J. (2023). Characterization of Silica (SiO₂) Based on Beach Sand from Sulawesi and Sumatra as Silicon Carbide (SiC) Base Material. *Journal of Chemical Technology and Metallurgy*, 58(3), 467-476.
 6. Rampe, M.J., Lombok, J.Z., Panawar, I., Tiwow, V.A., Rampe, H.L. (2023). Extraction of Silica (SiO₂) from White Sand, Sulawesi Island. *Advances in Science and Technology*, 128, 9-15.
 7. Rampe, M.J., Lombok, J.Z. (2024). *Kimia Material*. Penerbit NEM.
 8. Slarmanat, R., Rampe, M., Lombok, J. (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih dan Arang Tempurung Kelapa. *Fullerene Journal of Chemistry*, 9(1), 21-25.
 9. Fauzan, M.F.A., Sandi, I.A., Caprian, M.D., Rampe, M.J., Palloan, P., Tiwow, V.A. (2024). A Review of the Magnetic Susceptibility of Landfill Leachate as an Indicator Proxy of Heavy Metal Pollution. *AIP Conference Proceedings*, 2799(1), 020141.
 10. Tiwow, V.A., Sandi, I.A., Fauzan, M.F.A., Fitriani, Sambolangi, A., Rampe, M.J. (2024). Study of Magnetic Mineral Properties of Bat Cave Guano in the Rammang-Rammang Karst Area Using X-ray Diffraction Method and Its Potential as Organic Fertilizer. *AIP Conference Proceedings*, 2799(1), 020132.
 11. Fitriani, Fauzan, M.F.A., Rahmad, Sulistiawaty, Rampe, M.J., Rampe, H.L. (2024). A Review of the Potential of Magnetic Susceptibility Methods for Monitoring Soil Fertility for Horticultural Crops Cultivation in Indonesia. *AIP Conference Proceedings*, 2799(1), 020142.
 12. Sambolangi, A., Bastian, F., Bone, Y.A., Rampe, M.J., Tiwow, V.A. (2024). Magnetic Susceptibility and Heavy Metal Contamination in Bat Cave Guano in the Karst Area Rammang-Rammang, Maros, Indonesia. *AIP Conference Proceedings*, 2799(1), 020133.
 13. Atkins, P., Overton, T., Rourke, J., Weller, M., Armstrong, F. (2010). *Shriver & Atkins' Inorganic Chemistry*. Oxford University Press.
 14. Housecroft, C.E., Sharpe, A.G. (2018). *Inorganic Chemistry*. Pearson.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemical Thermodynamics
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133437
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Dr. Johny Z. Lombok, M.Si. Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia / English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, oral presentation, collaborative learning, projectbased learning, independent learning, LMS-based assignments.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Physical Chemistry</i>

<p>Module objectives/intended learning outcomes</p>	<p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand the laws of thermodynamics and their applications in chemical systems.</i> • <i>Explain thermodynamic functions (internal energy, enthalpy, entropy, Gibbs and Helmholtz free energy).</i> • <i>Describe equilibrium, spontaneity, and phase transitions.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> • <i>Apply thermodynamic principles to analyze chemical reactions.</i> • <i>Perform calorimetric and equilibrium experiments.</i> • <i>Interpret thermodynamic data and graphs.</i> <p><i>Competences</i></p> <ul style="list-style-type: none"> • <i>Integrate thermodynamic knowledge with chemical kinetics and physical chemistry.</i> • <i>Demonstrate accuracy and ethical responsibility in laboratory practice.</i> • <i>Communicate thermodynamic findings effectively in scientific reports and presentations.</i>
<p>Content</p>	<p><i>This course covers:</i></p> <ol style="list-style-type: none"> 1. <i>Introduction to chemical thermodynamics</i> 2. <i>Equations of state for ideal and real gases</i> 3. <i>First Law of Thermodynamics: energy, enthalpy, thermochemistry</i> 4. <i>Second Law of Thermodynamics: entropy, spontaneity</i> 5. <i>Gibbs and Helmholtz free energies and applications</i> 6. <i>Chemical equilibrium and phase equilibrium</i> 7. <i>Thermodynamics of electrochemical cells</i> 8. <i>Case studies: bioenergetics, materials chemistry, environmental systems</i>
<p>Examination forms</p>	<p><i>Written exams (mid-term and final), oral presentations, individual and group assignments, reports, and project-based assessments.</i></p>
<p>Study and examination requirements</p>	<p><i>To successfully pass the module, students must:</i></p> <ul style="list-style-type: none"> • <i>Attend at least 80% of lectures.</i> • <i>Complete all assignments and project reports.</i> • <i>Pass mid-term and final examinations with a minimum cumulative score C.</i>

Reading list	<ol style="list-style-type: none"> 1. Atkins, P.W. & de Paula, J. (2022). <i>Physical Chemistry</i>. Oxford University Press. 2. Levine, I.N. (2014). <i>Physical Chemistry</i>. McGraw-Hill. 3. Alberty, R.A. (1987). <i>Physical Chemistry</i>. Wiley. 4. Castellan, G. (1983). <i>Physical Chemistry</i>, 3rd ed. Addison Wesley. 5. Maron, S.H. & Lando, J.B. (1974). <i>Fundamentals of Physical Chemistry</i>. McMillan. 6. Ijang Rohman & Sri Mulyani (2000). <i>Physical Chemistry I</i>. 7. Rampe, M.J. & Tiwow, V.A. (2025). <i>Reaksi Sederhana dan Reaksi Rumit</i>. Penerbit NEM. 8. Rampe, M.J. (2025). <i>Arang Tempurung Kelapa: Sifat-sifat dan Aplikasi</i>. Penerbit NEM. 9. Rampe, M.J. (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM. 10. Rampe, M.J. & Lombok, J.Z. (2024). <i>Kimia Material</i>. Penerbit NEM. 11. Rampe, M.J. (2023). <i>Kimia Fisik (Jilid 1)</i>. Penerbit NEM. 12. Rampe, M.J. et al. (2025). <i>Surface Structure and Chemical Composition of Coconut Shell Charcoal Using Nira Aren Acid Activation</i>. <i>Journal of Chemical Technology and Metallurgy</i>, 60(2), 269-274.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemical Thermodynamics Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131436
Semester(s) in which the module is taught	<i>3rd Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia / English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<ul style="list-style-type: none"> • <i>Laboratory experiments</i> • <i>Discussion and oral presentation</i> • <i>Collaborative learning</i> • <i>Project-based learning</i> • <i>LMS-based assignments</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Physical Chemistry Practicum</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this Practicum, students are able to:</i></p> <p><i>Knowledge</i></p> <ul style="list-style-type: none"> • <i>Understand the laws of thermodynamics and their laboratory applications.</i> • <i>Explain thermodynamic functions (internal energy, enthalpy, entropy, Gibbs and Helmholtz free energy).</i>

	<ul style="list-style-type: none"> Describe equilibrium and spontaneity in chemical systems. <p><i>Skills</i></p> <ul style="list-style-type: none"> Conduct calorimetric experiments to measure enthalpy changes. Determine entropy and free energy changes experimentally. Apply thermodynamic principles to electrochemical cells and phase equilibrium. <p><i>Competences</i></p> <ul style="list-style-type: none"> Integrate theoretical concepts of thermodynamics with practical laboratory work. Demonstrate accuracy, reproducibility, and safety in laboratory practice. Communicate experimental findings effectively in reports and presentations.
Content	<p><i>This practicum covers:</i></p> <ol style="list-style-type: none"> Gas equations (ideal and real gases) First Law of Thermodynamics: calorimetry and enthalpy measurements Second Law of Thermodynamics: entropy and spontaneity experiments Gibbs and Helmholtz free energy determination Chemical equilibrium studies Phase equilibrium experiments Electrochemical cell thermodynamics
Examination forms	<p><i>Written exams (mid-term and final), practicum report, individual and group assignments, reports, and project-based assessments.</i></p>
Study and examination requirements	<p><i>To successfully pass the module, students must:</i></p> <ul style="list-style-type: none"> Attend at least 80% of practicum sessions Complete all assignments and project reports Pass mid-term and final examinations Achieve a minimum grade of C
Reading list	<ol style="list-style-type: none"> Atkins, P.W. & de Paula, J. (2022). <i>Physical Chemistry</i>. Oxford University Press. Levine, I.N. (2014). <i>Physical Chemistry</i>. McGraw-Hill. Alberty, R.A. (1987). <i>Physical Chemistry</i>. Wiley. Castellan, G. (1983). <i>Physical Chemistry</i>, 3rd ed. Addison Wesley. Maron, S.H. & Lando, J.B. (1974). <i>Fundamentals of Physical Chemistry</i>. McMillan. Ijang Rohman & Sri Mulyani (2000). <i>Physical Chemistry I</i>.

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| | <ol style="list-style-type: none">7. Rampe, M.J. & Tiwow, V.A. (2025). <i>Reaksi Sederhana dan Reaksi Rumit</i>. Penerbit NEM.8. Rampe, M.J. (2025). <i>Arang Tempurung Kelapa: Sifat-sifat dan Aplikasi</i>. Penerbit NEM.9. Rampe, M.J. (2024). <i>Carbon Quantum Dots</i>. Penerbit NEM.10. Rampe, M.J. & Lombok, J.Z. (2024). <i>Kimia Material</i>. Penerbit NEM.11. Rampe, M.J. (2023). <i>Kimia Fisik (Jilid 1)</i>. Penerbit NEM.12. Rampe, M.J. et al. (2025). <i>Surface Structure and Chemical Composition of Coconut Shell Charcoal Using Nira Aren Acid Activation</i>. <i>Journal of Chemical Technology and Metallurgy</i>, 60(2), 269-274. |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Instrumental Analysis
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133439
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si.</i>
Lecturer	<i>Abdon Saiya, M.Si. Vlagia I. Paat, M.Si. Mustapa, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, collaborative learning, and project-based learning.</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Fundamental of Analytical chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this module, students are able to:</i></p> <p>Knowledge</p> <ul style="list-style-type: none"> <i>• Understand the principles of instrumental analysis.</i> <i>• Explain the working principles of spectroscopic, chromatographic, and electroanalytical instruments.</i> <i>• Describe method development, optimization, and validation.</i> <p>Skills</p>

	<ul style="list-style-type: none"> Operate instruments such as UV-Vis, IR, FTIR, NMR, AAS, ICP-MS, HPLC, and GC-MS. Validate analytical methods (precision, accuracy, sensitivity, specificity). Interpret complex analytical data and spectra. <p>Competences</p> <ul style="list-style-type: none"> Integrate instrumental analysis knowledge with problem-solving in research and industry. Demonstrate accuracy, reproducibility, and ethical responsibility in analytical practice. Communicate analytical findings effectively in scientific reports and presentations.
Content	<p>This course covers:</p> <ol style="list-style-type: none"> Principles of instrumental analysis UV-Vis and IR spectroscopy FTIR and Raman spectroscopy NMR spectroscopy (1D and 2D techniques) Mass spectrometry (MS, GC-MS, LC-MS) Atomic absorption and emission spectroscopy (AAS, ICP-MS) Chromatographic techniques (HPLC, GC, TLC) Electroanalytical methods (potentiometry, voltammetry) Method development, optimization, and validation Case studies: food safety, pharmaceutical quality control, environmental monitoring
Examination forms	Written examinations (mid-term and final), assignments, discussions, and analytical calculation exercises.
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> Attendance \geq 80% Completion of all assignments and project reports Pass mid-term and final examinations with a minimum grade of
Reading list	<ol style="list-style-type: none"> Paat, V.I., Aloanis, A.A., Rumampuk, R.J. (2025). <i>Kimia Analitik Lanjut</i>. Penerbit Tahta Media. Paat, V.I., Aloanis, A.A. (2025). <i>Buku Ajar</i>

	<p><i>Elektrokimia</i>. Penerbit Tahta Media.</p> <ol style="list-style-type: none">3. Saiya, A. (2017). Analisis Residu Klorpirifos dalam Sayuran Kubis dengan HPLC. <i>Eksakta: Berkala Ilmiah Bidang MIPA</i>, 18(2), 77-85.4. Saiya, A., Gumolung, D., Caroles, J.D.S. (2018). Analisis Residu Pestisida dalam Tomat, Cabai Rawit dan Wortel. <i>Fullerene Journal of Chemistry</i>, 3(2), 63-69.5. Saiya, A., Caroles, J. (2023). Validasi Metode Analisis Beta Karoten dengan KCKT. <i>Fullerene Journal of Chemistry</i>, 7(1), 8-12.6. Skoog, D.A., Holler, F.J., & Crouch, S.R. (2018). <i>Principles of Instrumental Analysis</i>. Cengage Learning.7. Harris, D.C. (2020). <i>Quantitative Chemical Analysis</i>. W.H. Freeman.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Instrumental Analysis Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131438
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si.</i>
Lecturer	<i>Abdon Saiya, M.Si; Vlagia I. Paat, M.Si; Dr. Anderson A. Aloanis, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Laboratory experiments, discussions, report writing, project-based and collaborative learning.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> <i>Understand the principles of instrumental analysis in laboratory practice.</i> <i>Explain the working principles of spectroscopic, chromatographic, and electroanalytical instruments.</i> <i>Describe method validation and data interpretation.</i> <p>Skills</p> <ul style="list-style-type: none"> <i>Operate instruments such as UV-Vis, IR, FTIR, NMR, AAS, ICP-MS, HPLC, and GC-MS.</i>

	<ul style="list-style-type: none"> • Perform calibration, sample preparation, and measurement. • Validate analytical methods and interpret spectra/data. <p>Competences</p> <ul style="list-style-type: none"> • Integrate theoretical knowledge with practical laboratory work. • Demonstrate accuracy, reproducibility, and safety in instrumental analysis. • Communicate experimental findings effectively in reports and presentations.
Content	<p>The course includes practical work on:</p> <ol style="list-style-type: none"> 1. Introduction to instrumental analysis in practice 2. UV-Vis spectroscopy calibration and sample analysis 3. IR and FTIR fingerprinting of organic compounds 4. NMR spectroscopy (1D and 2D experiments) 5. Mass spectrometry (MS, GC-MS, LC-MS) 6. Atomic absorption spectroscopy (AAS) and ICP-MS for trace metals 7. Chromatographic techniques (HPLC, GC, TLC) 8. Electroanalytical methods (potentiometry, voltammetry) 9. Method validation and data analysis 10. Case studies: food safety, pharmaceutical quality control, environmental monitoring
Examination forms	<p>Practical performance assessment, written report, oral presentation, mid-term and final exams.</p>
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> • Attend at least 80% of practical sessions. • Complete and submit all practical reports. • Pass mid-term and final evaluations. • Demonstrate proper laboratory conduct and safety compliance.
Reading list	<ol style="list-style-type: none"> 1. Saiya, A. (2017). Analisis Residu Klorpirifos dalam Sayuran Kubis dengan HPLC. <i>Eksakta: Berkala Ilmiah Bidang MIPA</i>, 18(2), 77-85. 2. Saiya, A., Gumolung, D., Caroles, J.D.S. (2018). Analisis Residu Pestisida dalam Tomat, Cabai Rawit dan Wortel. <i>Fullerene Journal of Chemistry</i>, 3(2), 63-69. 3. Saiya, A., Caroles, J. (2023). Validasi Metode Analisis Beta Karoten dengan KCKT. <i>Fullerene Journal of Chemistry</i>, 7(1), 8-12. 4. Paat, V.I., Aloanis, A.A. (2025). <i>Kimia Analitik Lanjut</i>. Penerbit Tahta Media.

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| | <ol style="list-style-type: none">5. Paat, V.I., Aloanis, A.A. (2025). <i>Buku Ajar Elektrokimia</i>. Penerbit Tahta Media.6. Skoog, D.A., Holler, F.J., & Crouch, S.R. (2018). <i>Principles of Instrumental Analysis</i>. Cengage Learning7. Harris, D.C. (2020). <i>Quantitative Chemical Analysis</i>. W.H. Freeman8. Poole, C.F. (2019). <i>Chromatography Today</i>. Elsevier. |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Metabolism and Genetic Information
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133441
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Prof. Dr. Feti Fatimah, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si, Septiany Palilingan, M.Si, Dr. Meiske Mamuaja, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, collaborative learning, and project-based learning.</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this module, students are able to:</i></p> <p>Knowledge</p> <ul style="list-style-type: none"> • <i>Understand metabolic pathways (catabolism and anabolism).</i> • <i>Explain regulation of metabolism and energy transfer.</i> • <i>Describe genetic information flow (DNA replication, transcription, translation).</i> <p>Skills</p> <ul style="list-style-type: none"> • <i>Analyze enzyme kinetics and metabolic regulation.</i>

	<ul style="list-style-type: none"> • Perform laboratory techniques for genetic information analysis (DNA isolation, PCR, electrophoresis). • Interpret biochemical and genetic data. <p>Competences</p> <ul style="list-style-type: none"> • Integrate metabolism and genetic information in health, biotechnology, and pharmaceutical contexts. • Demonstrate accuracy and ethical responsibility in biochemical and genetic research. • Communicate findings effectively in scientific reports and presentations.
Content	<p><i>This course covers:</i></p> <ol style="list-style-type: none"> 1. Introduction to metabolism and genetic information 2. Carbohydrate metabolism (glycolysis, gluconeogenesis, TCA cycle) 3. Lipid metabolism (β-oxidation, biosynthesis) 4. Protein and amino acid metabolism 5. Nucleotide metabolism 6. DNA replication and repair 7. Transcription and RNA processing 8. Translation and protein synthesis 9. Regulation of gene expression 10. Case studies: metabolic disorders, genetic engineering, biotechnology applications
Examination forms	<p><i>Written examinations (mid-term and final), assignments, discussions, and analytical calculation exercises.</i></p>
Study and examination requirements	<p><i>To pass the module, students must:</i></p> <ul style="list-style-type: none"> • Attend at least 80% of lectures • Complete all assignments and project reports • Pass mid-term and final examinations • Achieve a minimum grade of C
Reading list	<ol style="list-style-type: none"> 1. Nelson, D.L. & Cox, M.M. (2021). <i>Lehninger Principles of Biochemistry</i>. W.H. Freeman. 2. Berg, J.M., Tymoczko, J.L., & Gatto, G.J. (2019). <i>Biochemistry</i>. W.H. Freeman. 3. Voet, D. & Voet, J.G. (2018). <i>Biochemistry</i>. Wiley. 4. Stryer, L. (2015). <i>Biochemistry</i>. W.H. Freeman.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Metabolism and Genetic Information Practicum
Module level	<i>Bachelor (Undergraduate)</i>
Code	30131440
Semester(s) in which the module is taught	<i>4th Semester</i>
Person responsible for the module	<i>Prof. Dr. Feti Fatimah, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si, Septiany Palilingan, M.Si, Dr. Meiske Mamujaja, M.Si</i>
Language	<i>Indonesian</i>
Relation to curriculum	<i>Compulsory course in the Bachelor of Chemistry Study Program</i>
Teaching methods	<i>Laboratory experiments, discussions, report writing, project-based and collaborative learning.</i>
Workload	<i>45 hours x 1 credit points = 45 hours per semester</i>
Credit points	<i>1 credit (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p><i>Upon completion of this Practicum, students are able to:</i></p> <p>Knowledge</p> <ul style="list-style-type: none"> <i>Understand metabolic pathways and genetic information processes in laboratory practice.</i> <i>Explain enzyme kinetics, DNA replication, transcription, and translation experimentally.</i> <i>Describe regulation of metabolism and gene expression.</i> <p>Skills</p> <ul style="list-style-type: none"> <i>Conduct enzyme assays and analyze metabolic regulation.</i>

	<ul style="list-style-type: none"> • Perform DNA/RNA isolation, PCR, and electrophoresis. • Apply bioinformatics tools for genetic data analysis. <p>Competences</p> <ul style="list-style-type: none"> • Integrate theoretical knowledge of metabolism and genetics with practical laboratory work. • Demonstrate accuracy, reproducibility, and safety in biochemical and genetic experiments. • Communicate experimental findings effectively in reports and presentations.
Content	<p>The course includes practical work on:</p> <ol style="list-style-type: none"> 1. Enzyme kinetics and metabolic regulation experiments 2. Carbohydrate metabolism assays (glycolysis, TCA cycle) 3. Lipid metabolism (β-oxidation, biosynthesis) 4. Protein metabolism and amino acid catabolism 5. DNA isolation and replication studies 6. RNA transcription and translation experiments 7. PCR amplification and electrophoresis 8. Bioinformatics analysis of genetic sequences 9. Case studies: metabolic disorders and genetic engineering
Examination forms	<p>Practical performance assessment, written report, oral presentation, mid-term and final exams.</p>
Study and examination requirements	<p>To pass the module, students must:</p> <ul style="list-style-type: none"> • Attend at least 80% of practical sessions. • Complete and submit all practical reports. • Pass mid-term and final evaluations. • Demonstrate proper laboratory conduct and safety compliance.
Reading list	<ol style="list-style-type: none"> 1. Nelson, D.L. & Cox, M.M. (2021). <i>Lehninger Principles of Biochemistry</i>. W.H. Freeman. 2. Berg, J.M., Tymoczko, J.L., & Gatto, G.J. (2019). <i>Biochemistry</i>. W.H. Freeman. 3. Voet, D. & Voet, J.G. (2018). <i>Biochemistry</i>. Wiley. 4. Stryer, L. (2015). <i>Biochemistry</i>. W.H. Freeman.

Module Handbook

Bachelor of Chemistry

5th Semester

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Laboratory Management Techniques
Module level	Bachelor/Undergraduate
Code	30133542
Semester(s) in which the module is taught	5 th Semester
Person responsible for the module	<i>Prof. Dr. Feti Fatimah, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si.; Chaleb Paul Maanari, M.Si.</i>
Language	Indonesian
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, Group Discussion, Case-Based Learning, Problem-Solving Exercise, Simulation, Document Development Practice, Internal Audit Practice</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	Basic Chemistry
Module objectives/intended learning outcomes	<p><i>Knowledge</i></p> <ul style="list-style-type: none"> <i>Understand principles of laboratory organization, safety, and management.</i> <i>Explain standard operating procedures (SOPs), chemical inventory systems, and waste management.</i> <p><i>Skills</i></p> <ul style="list-style-type: none"> <i>Apply laboratory safety protocols and risk assessment methods.</i> <i>Manage laboratory resources, equipment, and documentation.</i>

	<ul style="list-style-type: none"> • Design SOPs and laboratory workflow plans. <p>Competences</p> <ul style="list-style-type: none"> • Demonstrate responsibility, ethical awareness, and sustainability in laboratory management. • Collaborate effectively in laboratory teams. <p>Integrate management techniques into real laboratory practice.</p>
Content	<ol style="list-style-type: none"> 1. Introduction to laboratory management 2. History & development of ISO/IEC 17025 3. Quality management principles (7 quality principles) 4. Laboratory safety (K3L), MSDS, PPE 5. Equipment management: calibration, validation, maintenance 6. Chemical management: storage, labeling, waste handling 7. Laboratory documentation: SOPs, work instructions, reports 8. Risk management (ISO 31000) 9. Internal audit, accreditation (KAN, MRA) 10. Continual improvement 11. Personnel management: competence, training, task division 12. Customer handling & stakeholder relations 13. SOP and quality form development 14. Audit simulation & corrective action
Examination forms	<p>Quizzes, Assignments, Case Studies, Midterm Exam, Final Exam, Project/Document Development, Internal Audit Simulation</p>
Study and examination requirements	<ul style="list-style-type: none"> • Attendance \geq 80% • Completion of quizzes, assignments, and case studies • Mid-Semester Exam • Final Exam • Practice on document creation and internal audit • Active participation in LMS and class discussions
Reading list	<p>Main References:</p> <ol style="list-style-type: none"> 1. Ratliff, C. (2017). <i>Laboratory Safety and Management</i>. CRC Press. 2. Siregar, E. (2018). <i>Manajemen Laboratorium Pendidikan</i>. Prenada Media. 3. OECD. (2020). <i>Best Practices in Laboratory Safety and Management</i>. OECD Publishing. 4. ISO/IEC 17025:2017. <i>General Requirements for the Competence of Testing and Calibration Laboratories</i>. 5. Gopal, R. (2015). <i>Laboratory Management</i>. Springer.

Supporting References:

1. *Harmita (2014). Laboratory Management. UI Press. Additional updated references related to ISO, K3L, risk management, and laboratory accreditation.*

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Green Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132651
Semester(s) in which the module is taught	<i>5th Semester</i>
Person responsible for the module	<i>Dian Howan, M.Phil, Ph.D</i>
Lecturer	<i>Dian Howan, M.Phil, Ph.D ; Dr. Anderson A. Aloanis, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the 12 principles of green chemistry. • Explain sustainable chemical processes and renewable feedstocks. • Describe environmental and economic impacts of green chemistry. <p>Skills</p> <ul style="list-style-type: none"> • Design chemical processes with reduced waste and toxicity. • Apply green solvents, catalysts, and energy-efficient methods.

	<ul style="list-style-type: none"> Evaluate sustainability indicators in chemical industries. <p>Competences</p> <ul style="list-style-type: none"> Integrate green chemistry principles into laboratory and industrial practice. Demonstrate ethical responsibility in sustainable chemical innovation. Communicate sustainability-oriented findings effectively in reports and presentations.
Content	<ol style="list-style-type: none"> Introduction to green chemistry and sustainability The 12 principles of green chemistry Renewable feedstocks and bio-based materials Green solvents and catalysis Energy-efficient chemical processes Waste minimization and atom economy Case studies: pharmaceuticals, polymers, agrochemicals Green chemistry in industry and policy frameworks (SDGs, ISO standards) Laboratory applications: green synthesis and eco-friendly analysis
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance \geq 80% - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> Anastas, P.T., Warner, J.C. (1998). <i>Green Chemistry: Theory and Practice</i>. Oxford University Press. Lancaster, M. (2016). <i>Green Chemistry: An Introductory Text</i>. Royal Society of Chemistry. Matlack, A.S. (2010). <i>Introduction to Green Chemistry</i>. CRC Press. Clark, J.H., Macquarrie, D.J. (2008). <i>Handbook of Green Chemistry and Technology</i>. Wiley. <i>Etinilestradiol dengan Katalis FeCl₃. Fullerene Journal of Chemistry</i>, 6(1), 39-45.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemical Research Methodology
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133543
Semester(s) in which the module is taught	<i>5th Semester</i>
Person responsible for the module	<i>Dr. Anderson A. Aloanis, M.Si</i>
Lecturer	<i>Dr. Anderson A. Aloanis, M.Si; Vlagia Paat, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>All of basic module</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the philosophy and principles of scientific research in chemistry. • Explain research design, methodology, and ethical considerations. • Describe data collection, analysis, and interpretation methods. <p>Skills</p> <ul style="list-style-type: none"> • Formulate research questions and hypotheses. • Design experiments and select appropriate analytical techniques.

	<ul style="list-style-type: none"> • Write scientific reports, proposals, and publications. <p>Competences</p> <ul style="list-style-type: none"> • Integrate theoretical and practical knowledge into research projects. • Demonstrate ethical responsibility in conducting and reporting research. • Communicate research findings effectively in academic and professional contexts.
Content	<ol style="list-style-type: none"> 1. Introduction to chemical research methodology 2. Research design and planning 3. Literature review and citation management 4. Experimental design and laboratory safety 5. Data collection, statistical analysis, and interpretation 6. Writing scientific proposals and reports 7. Publication ethics and plagiarism awareness
Examination forms	<i>Mid-term and final written exams, individual/group assignments,</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance \geq 80% - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> 1. Creswell, J.W. (2018). <i>Research Design: Qualitative, Quantitative, and Mixed Methods Approaches</i>. Sage Publications 2. Day, R.A., Gastel, B. (2016). <i>How to Write and Publish a Scientific Paper</i>. Cambridge University Press. 3. ACS (2020). <i>ACS Style Guide: Effective Communication of Scientific Information</i>. American Chemical Society. 4. Babbie, E. (2021). <i>The Practice of Social Research</i>. Cengage Learning. 5. Yin, R.K. (2018). <i>Case Study Research and Applications</i>. Sage Publications. 6. FMIPAK (2026). <i>Panduan Penulisan tugas akhir</i>

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Polymer Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133544
Semester(s) in which the module is taught	<i>5th Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si ; Dr. Johnny Z. Lombok, M.Si. Soenandar Millian Tengker, S.Si., M.Si. Miftahul Jannah, S.Si., M.Si.</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Thermodynamics</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the structure, properties, and classification of polymers. • Explain polymerization mechanisms (addition, condensation, copolymerization). • Describe applications of polymers in industry, medicine, and sustainability. <p>Skills</p> <ul style="list-style-type: none"> • Synthesize and characterize polymers using

	<p>laboratory techniques.</p> <ul style="list-style-type: none"> Analyze thermal, mechanical, and chemical properties of polymers. Apply polymer chemistry principles to design new materials. <p>Competences</p> <ul style="list-style-type: none"> Integrate polymer chemistry knowledge with industrial and environmental applications. Demonstrate ethical responsibility in polymer production and waste management.
Content	<ol style="list-style-type: none"> Introduction to polymer chemistry Classification of polymers (natural, synthetic, biodegradable) Polymerization mechanisms: free radical, ionic, coordination, condensation Copolymerization and block polymers Polymer characterization (spectroscopy, chromatography, thermal analysis) Physical properties: crystallinity, glass transition, mechanical strength Industrial applications: plastics, fibers, rubbers, coatings Polymers in medicine, biotechnology, and nanomaterials Green polymers and sustainability (biodegradable plastics, recycling)
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> Odian, G. (2004). <i>Principles of Polymerization</i>. Wiley. Billmeyer, F.W. (1984). <i>Textbook of Polymer Science</i>. Wiley. Young, R.J., Lovell, P.A. (2011). <i>Introduction to Polymers</i>. CRC Press. Sperling, L.H. (2006). <i>Introduction to Physical Polymer Science</i>. Wiley. Matyjaszewski, K., Möller, M. (2012). <i>Polymer Science: A Comprehensive Reference</i>. Elsevier.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Natural Product Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133545
Semester(s) in which the module is taught	<i>5th Semester</i>
Person responsible for the module	<i>Dr. Emma J. Pongoh, M.Si</i>
Lecturer	<i>Dr. Anderson A. Aloanis, M.Si; Dr. Emma J. Pongoh, M.Si; Dr. Rymond Rumampuk, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Monofunctional organic chemistry and polyfunctional organic chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the chemistry of natural products (alkaloids, terpenes, flavonoids, saponins, peptides). • Explain biosynthetic pathways and structural diversity of natural compounds. • Describe applications of natural products in pharmaceuticals, nutraceuticals, and agrochemicals. <p>Skills</p> <ul style="list-style-type: none"> • Isolate and characterize natural products using chromatography and spectroscopy.

	<ul style="list-style-type: none"> • Conduct bioassays to evaluate biological activity. • Apply computational tools for structural elucidation and docking studies. <p>Competences</p> <ul style="list-style-type: none"> • Integrate natural product chemistry with drug discovery and sustainable development. • Demonstrate ethical responsibility in bioprospecting and biodiversity conservation. • Communicate findings effectively in scientific reports and presentations.
Content	<ol style="list-style-type: none"> 1. Introduction to natural product chemistry 2. Classification of natural products (alkaloids, terpenes, flavonoids, peptides, saponins) 3. Biosynthetic pathways and metabolic engineering 4. Isolation and purification techniques (solvent extraction, chromatography) 5. Natural products in traditional medicine and modern drug discovery 6. Sustainability and ethical issues in bioprospecting
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance \geq 80% - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> 1. Aloanis, A.A., Karundeng, M. (2020). Antioxidant Properties of Beringin (<i>Ficus benjamina</i> Linn.) Fruit. <i>Fullerene Journal of Chemistry</i>, 6(2), 165-170. 2. Saputra, T.R., Purnamasari, E., Aloanis, A.A. (2019). Isolasi Senyawa Flavonoid dari Tumbuhan Cocor Bebek sebagai Sediaan Inhibitor Korosi. <i>Fullerene Journal of Chemistry</i>, 4(2), 72-75. 3. Aloanis, A.A., Karundeng, M. (2018). Total Kandungan Antioksidan Ekstrak Etanol Buah Beringin (<i>Ficus benjamina</i> Linn.). <i>Fullerene Journal of Chemistry</i>, 4(1), 1-4. 4. Karundeng, M., Aloanis, A.A. (2017). Analisis Pemerangkapan Radikal Bebas Ekstrak Etanol Buah Beringin (<i>Ficus benjamina</i> Linn.). <i>Fullerene Journal of Chemistry</i>, 3(2), 37-39. 5. Gugule, S., Fatimah, F., Aloanis, A.A. (2017). Proses Pembuatan Biodiesel dari Etanol Nira Aren (<i>Arenga pinnata</i>).

6. Aloanis, A.A., Fahriana, Haryadi (2016). Skrining Fitokimia dan Uji Toksisitas Ekstrak Daun Balik Angin (*Mallotus sp.*) terhadap Larva *Artemia salina* Leach dengan Metode BSLT. *Fullerene Journal of Chemistry*, 2(2), 77-81.
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8. Pongoh, E.J., Machmudah, S., Rumampuk, R.J., Lombok, J.Z., Tiwow, V.A. (2024). Production of Bioethanol from Cap Tikus by Redistillation. *Journal of Chemical Technology and Metallurgy*, 60(5), 853-860.
9. Rumampuk, R.J., Kapahang, A., Pongoh, E.J. (2024). Studi Senyawa Metabolit Sekunder dari Fraksi Etil Asetat Daun Pare Hutan (*Momordica balsamina* L.). *Fullerene Journal of Chemistry*, 8(2), 78-82.
10. Pongoh, E.J., Rumampuk, R.J., Krisen, S.S., Werfete, H.C., Paramata, A.R. (2023). Isolasi dan Identifikasi Senyawa Fenil Pentanoat dari Fraksi Etil Asetat Sarang Semut (*Myrmecodia pendans*). *Jambura Journal of Chemistry*, 4(2), 62-66.
11. Pongoh, E.J., Rumampuk, R.J., Lukum, A., Kapahang, A. (2022). α -Glucosidase Inhibitor Activity of Some Indonesian *Syzygium* Extracts. *Jambura Journal of Chemistry*, 3(2), 99-104.
12. Kahiking, G.R., Rumampuk, R., Pongoh, E.J. (2021). Isolation and Identification of Glycoside Compounds from *n*-Butanol Fraction of Red Pakoba (*Syzygium sp.*). *Fullerene Journal of Chemistry*, 5(2), 53-57.
13. Pongoh, E.J., Rumampuk, R.J., Howan, D., Tamunu, V. (2020). Skrining Fitokimia dan Potensi Antilitiasis dari Ekstrak Etanol Daun Nusa Indah Putih (*Mussaenda pubescens*). *Fullerene Journal of Chemistry*, 4(2), 76-81.
14. Rumampuk, R.J. (2012). Complete Assignment of the ^1H and ^{13}C NMR Spectra of Camelliagenin A and A1-Barrigenol from *Barringtonia asiatica*. *The Open Natural Products Journal*, 5, 7-12.
15. Pongoh, E.J., Rombang, W.A.R., Rumampuk, R.J., Tarigan, P. (2011). An Antifeedant Saponin from Seeds of *Barringtonia asiatica*. *Asian Journal of Research in Chemistry*, 4(12), 1935-1940.
16. Rumampuk, R.J., Pongoh, E.J., Tarigan, P., Herlt, A.J., Mander, L.N. (2010). A Triterpene Ester

	<p><i>Saponin from the Seed of Barringtonia asiatica. Indonesian Journal of Chemistry, 3(3), 149-155.</i></p> <p>17. Pongoh, E.J., Rumampuk, R.J., Bahti, H.H., Tarigan, P., Mitova, M., Blunt, J.W. (2007). <i>Suatu Pentahidroksiflavanon dari Akar Albizia saponaria. Jurnal Kimia Indonesia, 2(1), 13-16.</i></p> <p>18. Pongoh, E.J., Rumampuk, R.J., Tarigan, P., Herlt, A.J., Mander, L.N. (2004). <i>Isolation of an Antifeedant Triterpenoid from the Seed of Barringtonia asiatica. Indonesian Journal of Chemistry, 4</i></p>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Structure Elucidation
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133546
Semester(s) in which the module is taught	<i>5th Semester</i>
Person responsible for the module	<i>Dr. Rymond Rumampuk, M.Si</i>
Lecturer	<i>Dr. Rymond Rumampuk, M.Si; Dr. Anderson A. Aloanis, M.Si; Dr. Emma J. Pongoh, M.Si;</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Basic Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand principles of structural elucidation using spectroscopic and computational methods. • Explain NMR, MS, IR, UV-Vis, and X-ray crystallography techniques. • Describe strategies for deducing structures of natural and synthetic compounds. <p>Skills</p> <ul style="list-style-type: none"> • Interpret spectral data to determine molecular structures.

	<ul style="list-style-type: none"> Use computational chemistry tools for structure prediction and validation. <p>Competences</p> <ul style="list-style-type: none"> Integrate experimental and computational approaches in structural elucidation. Demonstrate accuracy and ethical responsibility in reporting structures. Communicate structural analysis effectively in scientific reports and presentations.
Content	<ol style="list-style-type: none"> Introduction to structural elucidation Principles of spectroscopy (UV-Vis, IR, NMR, MS) Chromatographic separation and sample preparation Advanced NMR techniques (2D NMR, COSY, HSQC, HMBC) Mass spectrometry fragmentation analysis Case studies: natural products, bioactive compounds, synthetic molecules
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> Pongoh, E.J., Machmudah, S., Rumampuk, R.J., Lombok, J.Z., Tiwow, V.A. (2024). Production of Bioethanol from Cap Tikus by Redistillation. <i>Journal of Chemical Technology and Metallurgy</i>, 60(5), 853-860. Rumampuk, R.J., Kapahang, A., Pongoh, E.J. (2024). Studi Senyawa Metabolit Sekunder dari Fraksi Etil Asetat Daun Pare Hutan (<i>Momordica balsamina</i> L.). <i>Fullerene Journal of Chemistry</i>, 8(2), 78-82. Siwu, O., Rumampuk, R.J., Oktavia, B., Pongoh, E.J., Tengker, S.M.T., Paat, V.I. (2024). Formation Reaction of 17α (chlorovinyl-3-methyl-butene) Estradiol Through Addition Reaction of Terminal Alkyne to Ethinylestradiol with $ZnCl_2$ Catalyst. <i>Eksakta: Journal of Sciences and Data Analysis</i>, 1-7. Pongoh, E.J., Rumampuk, R.J., Dwiyanti, N.S., Pongoh, D.S. (2024). Mechanism of Addition Reaction of Cyclohexanol on 17α-ethinylestradiol (EE2) with $FeCl_3$ Media. <i>European Chemical</i>

- Bulletin*, 12(1), 977-984.
5. Pongoh, E.J., Rumampuk, R.J., Krisen, S.S., Werfete, H.C., Paramata, A.R. (2023). Isolasi dan Identifikasi Senyawa Fenil Pentanoat dari Fraksi Etil Asetat Sarang Semut (*Myrmecodia pendans*). *Jambura Journal of Chemistry*, 4(2), 62-66.
 6. Kahiking, G.R., Rumampuk, R., Pongoh, E.J. (2021). Isolation and Identification of Glycoside Compounds from n-Butanol Fraction of Red Pakoba (*Syzygium sp.*). *Fullerene Journal of Chemistry*, 5(2), 53-57.
 7. Nahor, E.M., Pongoh, E.J., Santoso, R.S. (2021). Identification and Characterization of Bioactive Compounds Dringo Rhizome (*Acorus calamus L.*). *Sains dan Pendidikan PPs UNIMA*, 1(2).
 8. Rumampuk, R.J. (2012). Complete Assignment of the ^1H and ^{13}C NMR Spectra of Camelliagenin A and A1-Barrigenol from *Barringtonia asiatica*. *The Open Natural Products Journal*, 5, 7-12.
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 10. Rumampuk, R.J., Pongoh, E.J., Tarigan, P., Herlt, A.J., Mander, L.N. (2010). A Triterpene Ester Saponin from the Seed of *Barringtonia asiatica*. *Indonesian Journal of Chemistry*, 3(3), 149-155.
 11. Pongoh, E.J., Rumampuk, R.J., Bahti, H.H., Tarigan, P., Mitova, M., Blunt, J.W. (2007). Suatu Pentahidroksiflavanon dari Akar *Albizia saponaria*. *Jurnal Kimia Indonesia*, 2(1), 13-16.
 12. Pongoh, E.J., Rumampuk, R.J., Tarigan, P., Herlt, A.J., Mander, L.N. (2004). Isolation of an Antifeedant Triterpenoid from the Seed of *Barringtonia asiatica*. *Indonesian Journal of Chemistry*, 4(1), 49-57.
 13. Herlt, A.J., Mander, L.N., Pongoh, E.J., Rumampuk, R.J., Tarigan, P. (2002). Two Major Saponins from Seeds of *Barringtonia asiatica*: Putative Antifeedants toward *Epilachna sp.* Larvae. *Journal of Natural Products*, 65(2), 115-120.
 14. Aloanis, A.A., Paat, V.I., Duengo, S. (2026). Total Synthesis and Potential Bioactivity of Linear Peptide LSAVTPG. *Fullerene Journal of Chemistry*, 11(2), 86-93.

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| | <ol style="list-style-type: none">15. Aloanis, A.A., Paat, V.I. (2025). <i>Peptida Antimikroba</i>. Penerbit Tahta Media.16. Najoan, J.M.J., Rumampuk, R.J., Paat, V.I., Aloanis, A.A. (2025). <i>In Silico Study of the YAKRCFR Peptide Structure and Its Interaction with Human Peroxiredoxin-5</i>. <i>Jurnal Beta Kimia</i>, 5(2), 1-8.17. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). <i>Structural Design and Synthesis of Cycloenegaline A Analogue</i>. <i>Journal of Heterocyclic Chemistry</i>, 62(9), 781-790.18. Aloanis, A.A., Najoan, J.M.J., Paat, V.I., Rumengan, S.M., Rumampuk, R.J. (2025). <i>*Total Synthesis and Molecular Docking Study of Peptide AWDY as an Anti-inflammation</i> |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Organic Synthesis
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133547
Semester(s) in which the module is taught	<i>5th Semester</i>
Person responsible for the module	<i>Dr. Anderson A. Aloanis, M.Si</i>
Lecturer	<i>Dr. Anderson A. Aloanis, M.Si; Prof. Dr. Sanusi Gugule, M.S; Dr. Rymond Rumampuk, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Reactivity and mechanism of organic reaction</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand principles and strategies of organic synthesis. • Explain retrosynthetic analysis and synthetic planning. • Describe functional group transformations and protecting group strategies. <p>Skills</p> <ul style="list-style-type: none"> • Design synthetic routes for complex organic molecules. • Perform laboratory synthesis using modern techniques. • Apply spectroscopic methods for product

	<p>characterization.</p> <p>Competences</p> <ul style="list-style-type: none"> • Integrate synthetic knowledge with medicinal, natural product, and polymer chemistry. • Demonstrate accuracy and safety in synthetic laboratory practice.
Content	<ol style="list-style-type: none"> 1. Introduction to organic synthesis 2. Retrosynthetic analysis and synthetic design 3. Functional group interconversions 4. Protecting groups and chemoselectivity 5. Stereoselective and regioselective synthesis 6. Multistep synthesis strategies 7. Peptide and bioactive compound synthesis 8. Case studies: pharmaceuticals, natural products, advanced materials
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> 1. Aloanis, A.A., Paat, V.I., Duengo, S. (2026). Total Synthesis and Potential Bioactivity of Linear Peptide LSAVTPG. <i>Fullerene Journal of Chemistry</i>, 11(2), 86-93. 2. Aloanis, A.A., Paat, V.I. (2025). <i>Peptida Antimikroba</i>. Penerbit Tahta Media. 3. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). Structural Design and Synthesis of Cycloenegalina A Analogue. <i>Journal of Heterocyclic Chemistry</i>, 62(9), 781-790. 4. Aloanis, A.A., Najooan, J.M.J., Paat, V.I., Rumengan, S.M., Rumampuk, R.J. (2025). Total Synthesis and Molecular Docking Study of Peptide AWVDY as an Anti-inflammation Agent. <i>JKPK (Jurnal Kimia dan Pendidikan Kimia)</i>, 10(2), 234-254. 5. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). Alanine-Rich Cyclopeptides: Natural Resources, Bioactivity, Total Synthesis, and Spectroscopy Identification. <i>ChemistrySelect</i>, 10(1), e202404379. 6. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2024). Total Synthesis of

	<p>Cycloenegalin A. <i>ChemistryOpen</i>, 13(12), e202400175.</p> <ol style="list-style-type: none"> 7. Aloanis, A.A., Paat, V.I. (2023). <i>Reaksi-Reaksi Senyawa Organik</i>. Penerbit Tahta Media. 8. Gugule, S., Aloanis, A.A. (2023). <i>Mempelajari Reaksi Transesterifikasi Terkatalisis Kalsium Oksida</i>. <i>Fullerene Journal of Chemistry</i>, 5(2), 73-77. 9. Simbolon, H.R.B., Rumampuk, R.J., Aloanis, A.A. (2024). <i>Kajian Regiokimia Markovnikov Melalui Mekanisme Reaksi Hidrasi Alkuna Terminal pada Etinilestradiol dengan Katalis FeCl₃</i>. <i>Fullerene Journal of Chemistry</i>, 6(1), 39-45. 10. Aloanis, A.A., Paat, V. I, (2024) <i>Sintesis Peptida</i>. Tahta 11. Warren, S., Wyatt, P. (2010). <i>Organic Synthesis: The Disconnection Approach</i>. Wiley. 12. Smith, M.B. (2013). <i>March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure</i>. Wiley. 13. Carey, F.A., Sundberg, R.J. (2007). <i>Advanced Organic Chemistry</i>. Springer. 14. Nicolaou, K.C., Sorensen, E.J. (1996). <i>Classics in Total Synthesis</i>. Wiley-VCH. 15. Clayden, J., Greeves, N., Warren, S. (2012). <i>Organic Chemistry</i>. Oxford University Press.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Advanced Analytical Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30133548
Semester(s) in which the module is taught	<i>5th Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si.</i>
Lecturer	<i>Abdon Saiya, M.Si; Vlagia I. Paat, M.Si; Mustapa, M.Si</i>
Language	<i>Indonesia/English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, presentation, discussion, group work, case study, and paper assignments</i>
Workload	<i>45 hours x 3 credit points = 135 hours per semester</i>
Credit points	<i>3 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Instrumental Analysis</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand advanced principles of analytical chemistry and instrumentation. • Explain method development, optimization, and validation. • Describe applications of advanced analytical techniques in food, pharmaceutical, and environmental chemistry. <p>Skills</p> <ul style="list-style-type: none"> • Operate advanced analytical instruments (HPLC, GC-MS, AAS, ICP-MS, FTIR, NMR).

	<ul style="list-style-type: none"> • Validate analytical methods (precision, accuracy, sensitivity, specificity). • Interpret complex analytical data and spectra. <p>Competences</p> <ul style="list-style-type: none"> • Integrate analytical chemistry knowledge with problem-solving in research and industry. • Demonstrate accuracy, reproducibility, and ethical responsibility in analytical practice. • Communicate analytical findings effectively in scientific reports and presentations.
Content	<ol style="list-style-type: none"> 1. Atomic absorption and emission spectroscopy (AAS, ICP-MS) 2. Electroanalytical methods (potentiometry, voltammetry) 3. Method development and validation 4. Chemometrics and data analysis 5. Case studies: food safety, pharmaceutical quality control, environmental monitoring
Examination forms	<i>Mid-term and final written exams, individual/group assignments, Practicum report</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Active participation in discussion and presentation - Completion of all assignments and quizzes - Mid-term exam (UTS) and final exam (UAS) - Passing grade: minimum C
Reading list	<ol style="list-style-type: none"> 16. Paat, V.I., Aloanis, A.A. (2025). <i>Kimia Analitik Lanjut</i>. Penerbit Tahta Media. 17. Skoog, D.A., Holler, F.J., Crouch, S.R. (2018). <i>Principles of Instrumental Analysis</i>. Cengage Learning. 18. Harris, D.C. (2020). <i>Quantitative Chemical Analysis</i>. W.H. Freeman. 19. Kellner, R., Mermet, J.M., Otto, M., Widmer, H.M. (1998). <i>Analytical Chemistry</i>. Wiley-VCH. 20. Christian, G.D. (2013). <i>Analytical Chemistry</i>. Wiley. 21. Miller, J.N., Miller, J.C. (2018). <i>Statistics and Chemometrics for Analytical Chemistry</i>. Pearson.

Module Handbook Bachelor of Chemistry 6th Semester

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Entrepreneurship
Module level	<i>Bachelor (Undergraduate)</i>
Code	30112211
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Abdon Saiya, S.Si, M.Si</i>
Lecturer	<i>Abdon Saiya, S.Si, M.Si;</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the principles, functions, and processes of entrepreneurship. • Recognize opportunities for innovation and business development in science and education. <p>Skills</p> <ul style="list-style-type: none"> • Develop business plans and project proposals.

	<ul style="list-style-type: none"> • Apply entrepreneurial strategies to academic and community contexts. • Communicate ideas effectively in entrepreneurial settings. <p>Competences</p> <ul style="list-style-type: none"> • Demonstrate creativity, initiative, and ethical responsibility in entrepreneurship. • Collaborate in teams to design and implement entrepreneurial projects. • Apply entrepreneurial thinking to real-life challenges in education and chemistry.
Content	<ul style="list-style-type: none"> • Entrepreneurial mindset and innovation • Opportunity recognition and feasibility analysis • Business models and planning • Financial literacy and resource management • Marketing strategies and digital entrepreneurship • Entrepreneurship in science and education • Project-based entrepreneurial practice • Ethics and sustainability in entrepreneurship • Presentation and evaluation of business projects
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<p><i>Main References</i></p> <ol style="list-style-type: none"> 1. Zimmerer, T.W. & Scarborough, N.M. (2018). <i>Essentials of Entrepreneurship and Small Business Management</i>. Pearson. 2. Hisrich, R.D., Peters, M.P., & Shepherd, D.A. (2020). <i>Entrepreneurship</i>. McGraw-Hill. 3. Kuratko, D.F. (2019). <i>Entrepreneurship: Theory, Process, Practice</i>. Cengage Learning. 4. Suryana, Y. (2013). <i>Kewirausahaan: Pedoman Praktis, Kiat dan Proses Menuju Sukses</i>. Salemba Empat. 5. Alma, B. (2014). <i>Kewirausahaan</i>. Alfabeta.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Environmental Impact Assessment Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132650
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Abdon Saiya, S.Si, M.Si</i>
Lecturer	<i>Abdon Saiya, S.Si, M.Si; Marlina Karundeng, M.Si;</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the principles, functions, and processes of entrepreneurship. • Recognize opportunities for innovation and business development in science and education. <p>Skills</p> <ul style="list-style-type: none"> • Develop business plans and project proposals.

	<ul style="list-style-type: none"> • Apply entrepreneurial strategies to academic and community contexts. • Communicate ideas effectively in entrepreneurial settings. <p>Competences</p> <ul style="list-style-type: none"> • Demonstrate creativity, initiative, and ethical responsibility in entrepreneurship. • Collaborate in teams to design and implement entrepreneurial projects. • Apply entrepreneurial thinking to real-life challenges in education and chemistry.
Content	<ul style="list-style-type: none"> • Entrepreneurial mindset and innovation • Opportunity recognition and feasibility analysis • Business models and planning • Financial literacy and resource management • Marketing strategies and digital entrepreneurship • Entrepreneurship in science and education • Project-based entrepreneurial practice • Ethics and sustainability in entrepreneurship • Presentation and evaluation of business projects
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance \geq 80% - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<p><i>Main References</i></p> <ol style="list-style-type: none"> 1. Saiya, A., Gumolung, D., Caroles, J.D.S. (2018). Analisis Residu Pestisida dalam Tomat, Cabai Rawit dan Wortel. <i>Fullerene Journal of Chemistry</i>, 3(2), 63-69. 2. Saiya, A., Caroles, J. (2023). Validasi Metode Analisis Beta Karoten dengan KCKT. <i>Fullerene Journal of Chemistry</i>, 7(1), 8-12. 3. Paat, V.I., Aloanis, A.A., Rumampuk, R.J. (2025). <i>Kimia Analitik Lanjut</i>. Penerbit Tahta Media. 4. Manahan, S.E. (2017). <i>Environmental Chemistry</i>. CRC Press. 5. Connell, D.W. (2005). <i>Basic Concepts of Environmental Chemistry</i>. CRC Press.

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| | <ol style="list-style-type: none">6. Reible, D. (2019). <i>Fundamentals of Environmental Engineering</i>. Springer.7. Bringezu, S., O'Brien, M. (2019). <i>Sustainable Resource Management: Global Trends, Visions and Policies</i>. Routledge. |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Food Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132652
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Prof. Dr. Feti Fatimah, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si; Prof. Dr. Sanusi Gugule, M.S.; Dr. Anderson A. Aloanis, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project-based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Structure and Biomolecule function</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the chemical composition of food (proteins, carbohydrates, lipids, vitamins, minerals). • Explain chemical reactions in food processing, preservation, and storage. • Describe food additives, contaminants, and safety regulations. <p>Skills</p>

	<ul style="list-style-type: none"> Analyze food components using chromatographic and spectroscopic methods. Evaluate nutritional quality and physicochemical properties of food. Apply chemistry principles to food innovation and product development. <p>Competences</p> <ul style="list-style-type: none"> Integrate chemistry knowledge with food science and technology. Demonstrate ethical responsibility in food safety and sustainability. Communicate findings effectively in scientific and community contexts.
Content	<ol style="list-style-type: none"> Introduction to food chemistry and nutrition Proteins in food: structure, function, and analysis Carbohydrates: sugars, starches, and dietary fiber Lipids: fatty acids, oils, and emulsifiers Vitamins and minerals: roles and stability in food systems Enzyme activity in food processing Food additives and contaminants Food preservation and chemical safety Case studies: functional foods, fortified products, and bioactive compounds Sustainability and SDG integration in food chemistry
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C

Reading list	<p><i>Main References</i></p> <ol style="list-style-type: none"> 1. Fatimah, F., Gugule, S., Maanari, C.P., Setyawati, I., Utami, A.R.P. (2024). Optimization, Characterization and Antioxidant Activity of Fish Protein Hydrolysate from Payangka (<i>Ophieleotris aporos</i>) using Papain and Bromelain. <i>Pakistan Journal of Biological Sciences</i>, 29(2), 92-101. 2. Lestari, E.P., Gugule, S., Fatimah, F., Maanari, C. (2024). Pengaruh Proses Pembuatan Terhadap Karakteristik Minyak Kelapa. <i>Jurnal FisTa: Fisika dan Terapannya</i>, 6(2), 75-81. 3. Iskandar, A., Fatimah, F., Aloanis, A. (2024). Physicochemical Properties of Rice Fortified with Payangka Fish Protein Hydrolysate. <i>Fullerene Journal of Chemistry</i>, 10(2), 65-71. 4. Belitz, H.-D., Grosch, W., Schieberle, P. (2019). <i>Food Chemistry</i>. Springer. 5. Fennema, O.R. (2017). <i>Fennema's Food Chemistry</i>. CRC Press. 6. Damodaran, S., Parkin, K.L. (2017). <i>Food Chemistry</i>. Wiley. 7. Coultate, T.P. (2016). <i>Food: The Chemistry of Its Components</i>. Royal Society of Chemistry.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Stereochemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132653
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Dr. Sanusi Gugule, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si; Prof. Dr. Sanusi Gugule, M.S.; Dr. Emma J. Pongoh, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program;</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Polyfunctional organic chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand stereochemical principles (chirality, enantiomers, diastereomers, conformational analysis). • Explain stereoelectronic effects and their role in reactivity. • Describe stereochemistry in biological systems and pharmaceuticals. <p>Skills</p>

	<ul style="list-style-type: none"> Analyze stereochemical outcomes of organic reactions. Use molecular models and computational tools to visualize stereochemistry. Apply stereochemical concepts to drug design, catalysis, and materials chemistry. <p>Competences</p> <ul style="list-style-type: none"> Integrate stereochemistry knowledge with organic reaction mechanisms. Demonstrate accuracy and ethical responsibility in stereochemical analysis. Communicate stereochemical reasoning effectively in reports and presentations.
Content	<ol style="list-style-type: none"> Introduction to stereochemistry and symmetry elements Chirality and stereoisomerism Enantiomers and diastereomers Conformational analysis of alkanes and cycloalkanes Stereoelectronic effects in organic reactions Stereochemistry of addition, substitution, and elimination reactions Stereochemistry in biological molecules (amino acids, sugars, nucleic acids) Applications in pharmaceuticals, catalysis, and materials science
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C

<p>Reading list</p>	<ol style="list-style-type: none"> 1. Gugule, S., Aloanis, A.A. (2023). <i>Mempelajari Reaksi Transesterifikasi Terkatalisis Kalsium Oksida</i>. <i>Fullerene Journal of Chemistry</i>, 5(2), 73-77. 2. Simbolon, H.R.B., Rumampuk, R.J., Aloanis, A.A. (2024). <i>Kajian Regiokimia Markovnikov Melalui Mekanisme Reaksi Hidrasi Alkuna Terminal pada Ethinilestradiol dengan Katalis FeCl₃</i>. <i>Fullerene Journal of Chemistry</i>, 6(1), 39-45. 3. Pongoh, E.J., Rumampuk, R.J., Tarigan, P. (2010). <i>A Triterpene Ester Saponin from the Seed of Barringtonia asiatica</i>. <i>Indonesian Journal of Chemistry</i>, 3(3), 149-155. 4. Aloanis, A.A., Paat, V.I. (2023). <i>Reaksi-Reaksi Senyawa Organik</i>. Penerbit Tahta Media. 5. Eliel, E.L., Wilen, S.H. (1994). <i>Stereochemistry of Organic Compounds</i>. Wiley. 6. Nasipuri, D. (2006). <i>Stereochemistry of Organic Compounds: Principles and Applications</i>. New Age International. 7. Carey, F.A., Giuliano, R.M. (2016). <i>Organic Chemistry</i>. McGraw-Hill. 8. Clayden, J., Greeves, N., Warren, S. (2012). <i>Organic Chemistry</i>. Oxford University Press.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Medicinal Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132654
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Dian Howan, M.Phil, Ph.D</i>
Lecturer	<i>Dian Howan, M.Phil, Ph.D; Dr. Anderson Aloanis, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the chemical basis of drug design, synthesis, and mechanism of action. • Explain pharmacokinetics and pharmacodynamics from a chemical perspective. • Describe bioactive natural products and synthetic analogues. <p>Skills</p>

	<ul style="list-style-type: none"> • Design and synthesize small molecules and peptides with medicinal potential. • Apply computational tools (molecular docking, SAR analysis) to drug discovery. • Conduct basic bioassays to evaluate antimicrobial, anticancer, or antioxidant activity. <p>Competences</p> <ul style="list-style-type: none"> • Integrate chemistry knowledge with biomedical applications. • Demonstrate ethical responsibility in medicinal chemistry research. • Communicate findings effectively in scientific reports and presentations.
Content	<ol style="list-style-type: none"> 1. Introduction to medicinal chemistry and drug discovery 2. Pharmacokinetics and pharmacodynamics 3. Structure-activity relationships (SAR) 4. Peptide-based therapeutics and antimicrobial agents 5. Natural products in drug discovery 6. Synthetic strategies for bioactive molecules 7. Computational approaches (molecular docking, QSAR) 8. Case studies: antimicrobial peptides, anticancer agents, functional foods 9. Sustainability and SDG integration in medicinal chemistry
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance \geq 80% - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C

<p>Reading list</p>	<ol style="list-style-type: none"> 1. Tiricz, H., Lima, R.M., Pfeiffer, I., Igaz, N., Domonkos, I., Jenei, S., Howan, D.H.O., et al. (2026). <i>Multifaceted antimicrobial mechanisms of NCR147-derived peptides from Medicago truncatula</i>. <i>Frontiers in Microbiology</i>, 16, 1720738. 2. Howan, D., Saiya, A., Pongoh, E. (2025). <i>Quantitative Determination of Ascorbic Acid Content in Two Varieties of Bird's Eye Chili (Capsicum frutescens L.) using UV-Vis Spectrophotometry</i>. <i>Fullerene Journal of Chemistry</i>, 10(2), 81-86. 3. Howan, D.H.O., Jenei, S., Szolomajer, J., Endre, G., Kondorosi, É., Tóth, G.K. (2023). <i>Enhanced antibacterial activity of substituted derivatives of NCR169C peptide</i>. <i>International Journal of Molecular Sciences</i>, 24(3), 2694. 4. Howan, D.H.O. (2023). <i>Synthesis and antimicrobial activity investigation of peptides derived from NCR169 and NCR147</i>. <i>PQDT-Global</i>. 5. Lima, R.M., Rathod, B.B., Tiricz, H., Howan, D.H.O., Al Bouni, M.A., Jenei, S., et al. (2022). <i>Legume plant peptides as sources of novel antimicrobial molecules against human pathogens</i>. <i>Frontiers in Molecular Biosciences</i>, 9, 870460. 6. Szerencsés, B., Gácsér, A., Endre, G., Domonkos, I., Tiricz, H., Vágvölgyi, C., et al. (2021). <i>Symbiotic NCR Peptide Fragments Affect the Viability, Morphology and Biofilm Formation of Candida Species</i>. <i>International Journal of Molecular Sciences</i>, 22(7), 3666. 7. Bajtai, A., Illisz, I., Howan, D.H.O., Tóth, G.K., Scriba, G.K.E., Lindner, W., Péter, A. (2021). <i>Enantioselective resolution of biologically active dipeptide analogs by HPLC applying Cinchona alkaloid-based ion-exchanger chiral stationary phases</i>. <i>Journal of Chromatography A</i>, 1611, 460574. 8. Aloanis, A.A., Paat, V.I., Duengo, S. (2026). <i>Total Synthesis and Potential Bioactivity of Linear Peptide LSAVTPG</i>. <i>Fullerene Journal of Chemistry</i>, 11(2), 86-93. 9. Aloanis, A.A., Paat, V.I. (2025). <i>Peptida Antimikroba</i>. Penerbit Tahta Media. 10. Naj Joan, J.M.J., Rumampuk, R.J., Paat, V.I., Aloanis, A.A. (2025). <i>In Silico Study of the YAKRCFR Peptide Structure and Its Interaction</i>
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	<p><i>with Human Peroxiredoxin-5. Jurnal Beta Kimia</i>, 5(2), 1-8.</p> <p>11. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). <i>Structural Design and Synthesis of Cycloenegalina A Analogue. Journal of Heterocyclic Chemistry</i>, 62(9), 781-790.</p> <p>12. Iskandar, A., Fatimah, F., Aloanis, A. (2025). <i>Physicochemical Properties of Rice Fortified with Payangka Fish Protein Hydrolysate. Fullere Journal of Chemistry</i>, 10(2), 65-71.</p> <p>13. Aloanis, A.A., Paat, V.I., Katuuk, D. (2025). <i>Buku Ajar Sintesis Organik Jilid I</i>. Penerbit Tahta Media.</p> <p>14. Aloanis, A.A., Paat, V.I. (2025). <i>Reaksi-Reaksi Senyawa Organik</i>. Penerbit Tahta Media.</p> <p>15. Aloanis, A.A., Najoran, J.M.J., Paat, V.I., Rumengan, S.M., Rumampuk, R.J. (2025). <i>Total Synthesis and Molecular Docking Study of Peptide AWVDY as an Anti-inflammation Agent. JKPK (Jurnal Kimia dan Pendidikan Kimia)</i>, 10(2), 234-254.</p>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chromatography
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132655
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Abdon Saiya, M.Si</i>
Lecturer	<i>Abdon Saiya, M.Si; Vlagia Paat, M.Si; Mustapa, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> - Understand principles of chromatographic separation (TLC, HPLC, GC, ion-exchange, affinity). - Explain retention mechanisms, resolution, and selectivity. - Describe applications of chromatography in food, pharmaceutical, and environmental chemistry. <p>Skills</p> <ul style="list-style-type: none"> - Perform chromatographic separations and validate

	<p>analytical methods.</p> <ul style="list-style-type: none"> - Apply quantitative and qualitative analysis using chromatographic techniques. - Interpret chromatograms and evaluate method performance. <p>Competences</p> <ul style="list-style-type: none"> - Integrate chromatographic knowledge with problem-solving in chemical analysis. - Demonstrate accuracy, safety, and ethical responsibility in laboratory practice. - Communicate results effectively in scientific reports and presentations
Content	<ul style="list-style-type: none"> • Fundamentals of chromatography (mobile phase, stationary phase, partitioning) • Thin-layer chromatography (TLC) • Column chromatography and preparative techniques • High-performance liquid chromatography (HPLC) • Gas chromatography (GC) • Ion-exchange and affinity chromatography • Method validation and optimization • Case studies: pesticide residues, food additives, pharmaceutical analysis
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<ol style="list-style-type: none"> 1. Paat, V.I., Aloanis, A.A. (2025). <i>Kimia Analitik Lanjut</i>. Penerbit Tahta Media. 2. Saruan, S.E., Pareta, D.N., Paat, V.I., Kanter, J.W., Tulandi, S.S. (2023). Identifikasi Kadar Natrium Benzoat Pada Saus Tomat Yang Beredar Di Pasar Beriman Kota Tomohon. <i>Majalah INFO Sains</i>, 3(2), 68-71. 3. Rambe, P., Maarisit, W., Tombuku, J., Paat, V. (2023). Identifikasi Formalin Pada Ikan Teri Di Pasar Tradisional Amurang. <i>Biofarmasetikal Tropis</i>, 5(1), 6-10. 4. Maliada, R., Tombuku, J.L., Tulandi, S.S., Paat, V.I.,

- Palandi, R.R. (2022). Uji Aktivitas Antimikroba Ekstrak n-Heksan Daun Senggani (*Melastoma candidum* D. Don) Terhadap *Escherichia coli* dan *Candida albicans*. *Majalah INFO Sains*, 2(2), 7-12.
5. Saiya, A. (2017). Analisis Residu Klorpirifos Dalam Sayuran Kubis Dengan Metode HPLC Di Beberapa Pasar Tradisional Di Sulawesi Utara. *Eksakta: Berkala Ilmiah Bidang MIPA*, 18(2), 77-85.
 6. Saiya, A., Gumolung, D., Howan, D.H.O. (2018). Optimasi dan Validasi Metode Analisis Residu Klorpirifos Menggunakan High Performance Liquid Chromatography (HPLC). *Fullerene Journal of Chemistry*, 2(2), 103-109.
 7. Saiya, A., Caroles, J. (2023). Validasi Metode Analisis Beta Karoten Menggunakan KCKT dan Aplikasinya Pada Penetapan Kadar Beta Karoten Dalam Buah Labu Kuning. *Fullerene Journal of Chemistry*, 7(1), 8-12.
 8. Sangian, E., Saiya, A., Rumengan, S.M. (2024). Analisis Kandungan Timbal Pada Minuman Susu Cair Kemasan Kaleng di Tondano Menggunakan Spektrofotometri Serapan Atom. *Jurnal Crystal*, 8(1), 191-196.
 9. Howan, D., Saiya, A., Pongoh, E. (2025). Quantitative Determination of Ascorbic Acid Content in Two Varieties of Bird's Eye Chili (*Capsicum frutescens* L.) using UV-Vis Spectrophotometry. *Fullerene Journal of Chemistry*, 10(2), 81-86.
 10. Saiya, A., Tengker, S. (2024). Optimasi Absorpsi Ion Logam Zn Menggunakan Arang Daun Eceng Gondok (*Eichhornia crassipes*) Sebagai Absorben. *Fullerene Journal of Chemistry*, 8(2), 59-64.
 11. Skoog, D.A., Holler, F.J., Crouch, S.R. (2018). *Principles of Instrumental Analysis*. Cengage Learning.
 12. Poole, C.F. (2019). *Chromatography Today*. Elsevier.
 13. Harris, D.C. (2020). *Quantitative Chemical Analysis*. W.H. Freeman.
 14. Snyder, L.R., Kirkland, J.J., Dolan, J.W. (2010). *Introduction to Modern Liquid Chromatography*. Wiley.

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Computational Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132656
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Dr. Anderson Aloanis, M.Si</i>
Lecturer	<i>Dr. Anderson Aloanis, M.Si ; Vlagia Paat, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand principles of computational chemistry (quantum mechanics, molecular mechanics, docking, dynamics). • Explain applications of computational methods in drug design, materials, and bioactive compounds. • Describe limitations and validation of computational approaches.

	<p>Skills</p> <ul style="list-style-type: none"> • Perform molecular modeling and docking studies using computational tools. • Analyze peptide and small molecule structures in silico. • Interpret computational data and compare with experimental results. <p>Competences</p> <ul style="list-style-type: none"> • Integrate computational methods with experimental chemistry. • Demonstrate accuracy, reproducibility, and ethical responsibility in computational research. • Communicate computational findings effectively in scientific reports and presentations.
Content	<ul style="list-style-type: none"> • Introduction to computational chemistry and software tools • Quantum chemistry basics (DFT, ab initio methods) • Molecular mechanics and force fields • Molecular docking and dynamics simulations • Case studies: bioactive peptides, drug design, materials chemistry • Validation of computational models with experimental data • Applications in medicinal chemistry, environmental chemistry, and nanomaterials
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C

<p>Reading list</p>	<ol style="list-style-type: none"> 1. Najoan, J.M.J., Rumampuk, R.J., Paat, V.I., Aloanis, A.A. (2025). <i>In Silico Study of the YAKRCFR Peptide Structure and Its Interaction with Human Peroxiredoxin-5</i>. <i>Jurnal Beta Kimia</i>, 5(2), 1-8. 2. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). <i>Structural Design and Synthesis of Cycloenegalina A Analogue</i>. <i>Journal of Heterocyclic Chemistry</i>, 62(9), 781-790. 3. Paat, V.I., Aloanis, A.A., Najoan, J.M.J. (2025). <i>Molecular Docking of Cycloenegalina A as Anticancer</i>. <i>Fullerene Journal of Chemistry</i>, 10(1), 26-33. 4. Aloanis, A.A., Najoan, J.M.J., Paat, V.I., Rumengan, S.M., Rumampuk, R.J. (2025). <i>Total Synthesis and Molecular Docking Study of Peptide AWDY as an Anti-inflammation Agent</i>. <i>JKPK (Jurnal Kimia dan Pendidikan Kimia)</i>, 10(2), 234-254. 5. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). <i>Alanine-Rich Cyclopeptides: Natural Resources, Bioactivity, Total Synthesis, and Spectroscopy Identification</i>. <i>ChemistrySelect</i>, 10(1), e202404379. 6. Jensen, F. (2017). <i>Introduction to Computational Chemistry</i>. Wiley. 7. Cramer, C.J. (2013). <i>Essentials of Computational Chemistry: Theories and Models</i>. Wiley. 8. Leach, A.R. (2001). <i>Molecular Modelling: Principles and Applications</i>. Pearson. 9. Frenkel, D., Smit, B. (2002). <i>Understanding Molecular Simulation</i>. Academic Press.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Mapalus In Global Perspective
Module level	<i>Bachelor (Undergraduate)</i>
Code	30112420
Semester(s) in which the module is taught	<i>6th Semester</i>
Person responsible for the module	<i>Dr. Sanusi Gugule, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si; Prof. Dr. Sanusi Gugule, M.S;</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>University course</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, projectbased learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the concept of Mapalus (collective cooperation in Minahasa culture). • Explain its historical, cultural, and social significance. • Compare Mapalus with global cooperative traditions (e.g., Japanese Kumi, African Ubuntu, Latin American Minga). <p>Skills</p>

	<ul style="list-style-type: none"> Analyze socio-cultural practices through interdisciplinary frameworks. Conduct comparative studies between local and global cooperative systems. Apply Mapalus principles to modern contexts (sustainability, education, community development). <p>Competences</p> <ul style="list-style-type: none"> Integrate cultural heritage with global perspectives. Demonstrate ethical responsibility in community-based research. Communicate findings effectively in academic and public contexts.
Content	<ul style="list-style-type: none"> Introduction to Mapalus: history and philosophy Mapalus in Minahasa society: values and practices Comparative cooperative traditions worldwide Mapalus and sustainable development (SDGs) Mapalus in education, agriculture, and social empowerment Case studies: Mapalus in modern institutions Globalization and the transformation of local traditions Fieldwork: observing and documenting Mapalus practices
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<ol style="list-style-type: none"> <i>Underline Publishing (2023). Mapalus dalam Perspektif Global.</i> <i>YBLI Institute (2023). Keberadaan Mapalus di Komunitas Minahasa.</i> <i>Underline Publishing (2024). Model Kepemimpinan Mapalus.</i> <i>Literacy Institute (2024). Mapalus dan Pengembangan Kebudayaan Nasional.</i>

Module Handbook

Bachelor of Chemistry

7th Semester

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Internship
Module level	<i>Bachelor (Undergraduate)</i>
Code	30134757
Semester(s) in which the module is taught	<i>7th Semester</i>
Person responsible for the module	<i>Head of Department (Chemistry)</i>
Lecturer	<i>Program Supervisor</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory capstone program; integrates academic knowledge with social engagement and community empowerment</i>
Teaching methods	<ul style="list-style-type: none"> • <i>Fieldwork and community engagement Group projects and collaborative learning</i> • <i>Problem-based learning (PBL)</i> • <i>Independent learning and reflection journal</i>
Workload	<i>45 hours x 4 credit points = 180 hours per semester</i>
Credit points	<i>4 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>All of basic module</i>
Module objectives/intended learning outcomes	<p>Upon completion of this program, students are able to:</p> <p>Knowledge</p> <ul style="list-style-type: none"> • Understand organizational structures, workflows, and professional ethics in chemistry-related industries. • Apply chemistry concepts to real-world problems in laboratory, production, or

	<p>research settings.</p> <p>Skills</p> <ul style="list-style-type: none"> • Operate laboratory instruments and analytical tools in professional environments. • Conduct applied research, quality control, or product development. • Communicate effectively in professional reports and presentations. <p>Competences</p> <ul style="list-style-type: none"> • Integrate academic knowledge with professional practice. • Demonstrate teamwork, leadership, and adaptability in workplace settings. • Uphold ethical standards and contribute to sustainable development goals (SDGs).
Content	<ul style="list-style-type: none"> • Orientation and workplace introduction • Laboratory practice and safety compliance • Analytical chemistry applications in industry • Quality control and assurance methods • Research and development projects • Environmental and sustainability practices in chemical industries • Professional reporting and documentation
Examination forms	<ul style="list-style-type: none"> • <i>Internship proposal and placement approval</i> • <i>Progress reports and supervisor evaluations</i> • <i>Final internship report (scientific and professional format)</i> • <i>Oral presentation and seminar</i>
Study and examination requirements	<p><i>To successfully pass the module, students must:</i></p> <ul style="list-style-type: none"> • <i>Attend at least 80% of internship activities</i> • <i>Submit progress and final reports</i> • <i>Receive satisfactory evaluations from both academic and industry supervisors</i> • <i>Pass final seminar with a minimum grade of</i>

Reading list	<p><i>Main References</i></p> <ol style="list-style-type: none">1. ACS (2020). <i>ACS Style Guide: Effective Communication of Scientific Information</i>. American Chemical Society.2. Kolb, D.A. (2014). <i>Experiential Learning: Experience as the Source of Learning and Development</i>. Pearson Education.3. Skoog, D.A., Holler, F.J., & Crouch, S.R. (2018). <i>Principles of Instrumental Analysis</i>. Cengage Learning.4. Harris, D.C. (2020). <i>Quantitative Chemical Analysis</i>. W.H. Freeman.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Community Service Program
Module level	<i>Bachelor (Undergraduate)</i>
Code	30134649
Semester(s) in which the module is taught	<i>7th Semester</i>
Person responsible for the module	<i>Head of Department (Chemistry)</i>
Lecturer	<i>Program Supervisor</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory capstone program; integrates academic knowledge with social engagement and community empowerment</i>
Teaching methods	<ul style="list-style-type: none"> • <i>Fieldwork and community engagement Group projects and collaborative learning</i> • <i>Problem-based learning (PBL)</i> • <i>Independent learning and reflection journal</i>
Workload	<i>45 hours x 4 credit points = 180 hours per semester</i>
Credit points	<i>4 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>All of basic module</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand social, cultural, and environmental contexts of community development. • Apply chemistry knowledge to solve real-world problems (e.g., waste management, clean water, food safety, sustainable agriculture).

	<p>Skills</p> <ul style="list-style-type: none"> • Design and implement community-based projects. • Communicate effectively with diverse stakeholders. • Document and evaluate project outcomes using scientific and social indicators. <p>Competences</p> <ul style="list-style-type: none"> • Integrate academic knowledge with community service. • Demonstrate leadership, teamwork, and ethical responsibility. • Contribute to Sustainable Development Goals (SDGs) through local initiatives.
Content	<ul style="list-style-type: none"> • Introduction to community service and empowerment models • Needs assessment and project planning • Implementation of chemistry-based community projects (e.g., eco-friendly soap, biochar, food safety testing) • Monitoring and evaluation of project outcomes • Reflection and reporting (scientific and social impact) • Final seminar and dissemination of results
Examination forms	<ul style="list-style-type: none"> • <i>Fieldwork performance evaluation</i> • <i>Group project report</i> • <i>Reflection journal</i>
Study and examination requirements	<ul style="list-style-type: none"> • <i>Attend at least 80% of fieldwork and seminars</i> • <i>Submit project proposals and final reports</i> • <i>Actively participate in community engagement activities</i> • <i>Pass final evaluation with a minimum grade of C</i>
Reading list	<p><i>Main References</i></p> <ol style="list-style-type: none"> 1. <i>Bingle, R.G., Hatcher, J.A. (2010). International Service Learning: Conceptual Frameworks and Research. Stylus Publishing.</i> 2. <i>Jacoby, B. (2015). Service-Learning Essentials: Questions, Answers, and Lessons Learned. Jossey-Bass.</i> 3. <i>Kolb, D.A. (2014). Experiential Learning: Experience as the Source of Learning and Development. Pearson Education.</i>

Module Handbook

Bachelor of Chemistry

8th Semester

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Thesis
Module level	<i>Bachelor (Undergraduate)</i>
Code	30136893
Semester(s) in which the module is taught	<i>8th Semester</i>
Person responsible for the module	<i>Head of Department (Chemistry)</i>
Lecturer	<i>Undergraduate thesis supervisor</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Compulsory capstone module in the Chemistry Study Program; integrates knowledge from all expertise groups (Organic, Inorganic, Physical, Analytical, Biochemistry, and Applied Chemistry)</i>
Teaching methods	<ul style="list-style-type: none"> • <i>Independent research under supervision</i> • <i>Literature review and critical analysis</i> • <i>Laboratory work and field studies</i> • <i>Regular consultation meetings with supervisors</i> • <i>Oral presentation and defense</i>
Workload	<i>45 hours x 6 credit points = 270 hours per semester</i>
Credit points	<i>6 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>All of the module</i>
Module objectives/intended learning outcomes	<p>Upon completion of this thesis module, students are able to:</p> <p>Knowledge</p> <ul style="list-style-type: none"> • <i>Demonstrate mastery of chemistry concepts in a chosen research area.</i>

	<ul style="list-style-type: none"> Understand research design, methodology, and ethical considerations. <p>Skills</p> <ul style="list-style-type: none"> Conduct independent research, including experimental design, data collection, and analysis. Apply advanced analytical and computational tools to solve chemical problems. Write a scientific thesis following academic and publication standards. <p>Competences</p> <ul style="list-style-type: none"> Integrate theoretical and practical knowledge into a coherent research project. Communicate scientific findings effectively through written thesis and oral defense. Demonstrate critical thinking, problem-solving, and ethical responsibility in research.
Content	<ul style="list-style-type: none"> Research proposal preparation and approval Literature review and theoretical framework Experimental design and methodology Data collection and analysis Discussion and interpretation of results Thesis writing (structure, formatting, referencing) Oral presentation and defense
Examination forms	<ul style="list-style-type: none"> <i>Proposal seminar</i> <i>Progress reports</i> <i>Final thesis submission</i> <i>Oral defense (thesis examination)</i>
Study and examination requirements	<p><i>To successfully pass the module, students must:</i></p> <ul style="list-style-type: none"> <i>Submit a research proposal approved by supervisors and department</i> <i>Conduct research according to ethical and safety guidelines</i> <i>Submit a complete thesis document following faculty formatting standards</i> <i>Defend the thesis in front of an examination committee</i> <i>Achieve a minimum grade of C</i>
Reading list	<p><i>Main References</i></p> <ol style="list-style-type: none"> <i>FMIPAK Unima. (2026). Panduan Penulisan Tugas Akhir.</i>

Elective Courses

Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Chemistry of Mineral Resources
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132758
Semester(s) in which the module is taught	<i>6th or 7th Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si; Miftahul Jannah, S.Si., M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Elective course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project-based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Inorganic metal chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the chemistry of mineral resources and their industrial relevance. • Explain mineral formation, classification, and chemical composition. • Describe extraction, beneficiation, and utilization of mineral resources. <p>Skills</p> <ul style="list-style-type: none"> • Characterize minerals using analytical

	<p>techniques (XRD, AAS, ICP-MS, SEM).</p> <ul style="list-style-type: none"> • Apply chemical methods for mineral extraction and purification. • Evaluate environmental impacts of mineral resource exploitation. <p>Competences</p> <ul style="list-style-type: none"> • Integrate mineral chemistry with sustainable resource management. • Demonstrate accuracy, reproducibility, and ethical responsibility in mineral resource studies. • Communicate findings effectively in scientific reports and presentations.
Content	<ul style="list-style-type: none"> • Introduction to mineral resources and their chemistry • Classification of minerals (silicates, oxides, sulfides, carbonates, phosphates) • Mineral formation and geochemical processes • Analytical techniques for mineral characterization (XRD, SEM, ICP-MS) • Extraction and beneficiation methods • Industrial applications of mineral resources (metals, ceramics, semiconductors) • Environmental chemistry of mining and mineral processing • Case studies: silica, iron sand, rare earth elements, heavy metals • Sustainable development and mineral resource management
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<ol style="list-style-type: none"> 1. Tiwow, V.A., Rampe, M.J., Arsyad, M. (2023). <i>Kajian Suseptibilitas Magnetik Bergantung Frekuensi terhadap Pasir Besi Kabupaten Takalar</i>. <i>Jurnal Sainsmat</i>, 7(2), 136-146. 2. Arsyad, M., Tiwow, V.A., Rampe, M.J. (2018).

	<p><i>Analysis of Magnetic Minerals of Iron Sand Deposit in Sampulungan Beach, Takalar Regency, South Sulawesi using the X-ray Diffraction Method. Journal of Physics: Conference Series, 1120(1), 012060.</i></p> <ol style="list-style-type: none"> 3. Rampe, M.J., Lombok, J.Z., Tiwow, V.A., Tengker, S.M.T., Bua, J. (2023). <i>Characterization of Silica (SiO₂) Based on Beach Sand from Sulawesi and Sumatra as Silicon Carbide (SiC) Base Material. Journal of Chemical Technology and Metallurgy, 58(3), 467-476.</i> 4. Rampe, M.J., Lombok, J.Z., Panawar, I., Tiwow, V.A., Rampe, H.L. (2023). <i>Extraction of Silica (SiO₂) from White Sand, Sulawesi Island. Advances in Science and Technology, 128, 9-15.</i> 5. Slarmanat, R., Rampe, M., Lombok, J. (2024). <i>Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih dan Arang Tempurung Kelapa. Fullerene Journal of Chemistry, 9(1), 21-25.</i> 6. Mustapa, M., Utami, A.R.P., Maanari, C.P., Jannah, M., Rumengan, S.M. (2024). <i>The Influence of Heavy Metals on the Absorption of Cationic Dyes. Jurnal Pena Sains, 11(1), 42-47.</i> 7. Deer, W.A., Howie, R.A., Zussman, J. (2013). <i>An Introduction to the Rock-Forming Minerals. Mineralogical Society.</i> 8. Klein, C., Dutrow, B. (2007). <i>Manual of Mineral Science. Wiley.</i> 9. Greenwood, N.N., Earnshaw, A. (2012). <i>Chemistry of the Elements. Elsevier.</i> 10. Nordstrom, D.K., Alpers, C.N. (1999). <i>Geochemistry of Acid Mine Drainage. Reviews in Mineralogy and Geochemistry.</i> 11. Habashi, F. (1999). <i>Handbook of Extractive Metallurgy. Wiley-VCH.</i>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Essential Oil Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30132759
Semester(s) in which the module is taught	<i>6th or 7th Semester</i>
Person responsible for the module	<i>Prof. Dr. Sanusi Gugule, M.S</i>
Lecturer	<i>Prof. Dr. Sanusi Gugule, M.S; Prof. Dr. Feti Fatimah, M.Si; Dr. Emma J. Pongoh, M.Si;</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Elective course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project-based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Polyfunctional organic chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the chemistry, biosynthesis, and classification of essential oils. • Explain extraction methods (steam distillation, solvent extraction, supercritical CO₂). • Describe chemical composition and bioactivity of essential oils. <p>Skills</p> <ul style="list-style-type: none"> • Isolate and characterize essential oils using

	<p>chromatographic and spectroscopic techniques.</p> <ul style="list-style-type: none"> • Conduct GC-MS analysis for component identification. • Perform bioassays to evaluate antimicrobial, antioxidant, and therapeutic properties. <p>Competences</p> <ul style="list-style-type: none"> • Integrate essential oil chemistry with pharmaceutical, food, and cosmetic applications. • Demonstrate accuracy, reproducibility, and ethical responsibility in essential oil research. • Communicate findings effectively in scientific reports and presentations.
Content	<ul style="list-style-type: none"> • Introduction to essential oils and volatile compounds • Biosynthesis of terpenes and phenylpropanoids • Extraction and isolation techniques • Chromatographic and spectroscopic characterization (GC, GC-MS, IR, NMR) • Chemical composition and structure-activity relationships • Biological activities (antimicrobial, antioxidant, anti-inflammatory) • Industrial applications (pharmaceuticals, food, cosmetics, aromatherapy) • Case studies: clove oil, nutmeg oil, citronella oil, eucalyptus oil • Sustainability and ethical issues in essential oil production
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C

Reading list

1. Lestari, E.P., Gugule, S., Fatimah, F., Maanari, C. (2023). Pengaruh Proses Pembuatan Terhadap Karakteristik Minyak Kelapa. *Jurnal FisTa: Fisika dan Terapannya*, 6(2), 75-81.
2. Watuseke, R.D., Gugule, S., Lombok, J.Z. (2023). Analysis of Chemical Components and Antioxidant Activity in Nutmeg Shell Liquid Smoke Processed through Rotary Evaporator Purification. *Indonesian Journal of Chemical Research*, 12.
3. Tarigan, R.Y.W.B., Gugule, S., Tuerah, J.M., Maanari, C. (2023). Pengaruh Katalis Terhadap Rendemen Reaksi Transesterifikasi. *Fullerene Journal of Chemistry*, 8(2), 65-72.
4. Fatimah, F., Gugule, S., Katja, D.G., Wuntu, A.D., Karouw, S., Tambas, J.S. (2023). Exploring the Potential of Sago Caterpillars as Cooking Oils: Extraction, Purifying and Characterization. *Pakistan Journal of Biological Sciences*, 26(11), 557-566.
5. Maanari, C.P., Gugule, S., Fatimah, F., Utami, A.R.P., Mustapa, M. (2023). Effect of Potassium Hydroxide Concentration as a Catalyst on the Yield of Coconut Oil (*Cocos nucifera*) Transesterification. *Indonesian Journal of Pure and Applied Chemistry*, 6(3), 142-150.
6. Maanari, C.P., Gugule, S., Fatimah, F., Rumengan, S.M., Utami, A.R.P. (2024). Impact of Ferric Chloride-Induced Oxidation on the Physicochemical Characteristics of Chicken Fat and Its Biodiesel. *Jurnal Akademika Kimia*, 15(1), 17-24.
7. Lewa, S., Gugule, S. (2022). Cinnamon (*Cinnamomum burmannii*) Bark Essential Oil as Raw Material for Skin Cream and Anti-bacterial. *Acta Chimica Asiana*, 5(1), 158-165.
8. Lewa, S., Gugule, S. (2022). Cinnamon (*Cinnamomum burmannii*) Bark Essential Oil as Raw Material.
9. Fatimah, F., Gugule, S., Katja, D.G. (2021). Extraction and Identification of Lipid Profile of Oils from Sago Caterpillars.
10. Kosegeran, S.G.R., Gugule, S., Lombok, J.Z. (2021). Sintesis Triacetin dari Gliserol dan Asam Asetat dengan Katalis Zeolit Alam Termodifikasi. *Fullerene Journal of Chemistry*, 6(2), 155-160.
11. Gugule, S., Aloanis, A.A. (2020). Mempelajari Reaksi Transesterifikasi Terkatalisis Kalsium Oksida. *Fullerene Journal of Chemistry*, 5(2), 73-77.
12. Gugule, S., Fatimah, F., Maanari, C.P., Tallei, T.E. (2020). Data on the Use of Virgin Coconut Oil and Bioethanol Produced from Sugar Palm Sap as Raw Materials for Biodiesel Synthesis. *Data in Brief*, 29, 105199.
13. Gugule, S., Fatimah, F., Maanari, C.P. (2019). Pemisahan dan Karakterisasi Etanol dari Nira Aren

	<p>(<i>Arenga pinnata</i>). <i>IPTEK Journal of Proceedings Series</i>, 13-17.</p> <p>14. Gugule, S., Anom, I.D.K. (2019). Pemisahan dan Identifikasi Komponen-Komponen Utama Minyak Atsiri dari Daun Cengkeh Segar dan Kering (<i>Syzygium aromaticum</i>). <i>Fullerene Journal of Chemistry</i>, 4(2), 44-47.</p> <p>15. Fatimah, F., Pelealu, J.J., Gugule, S., Korompot, A.R.H., Monintja, V.W., Tallej, T.E. (2019). Chemical Characteristics of Tuna Fish Bakasang. <i>IOP Conference Series: Materials Science and Engineering</i>, 567(1), 012040.</p> <p>16. Fatimah, F., Tungadi, J.M., Gugule, S., Kaurong, P.A., Tallej, T.E. (2019). Processing Optimizing of Bakasang from Skipjack Tuna Fish (<i>Katsuwonus pelamis</i>) Viscera Using Surface Response Methods.</p> <p>17. Fatimah, F., Gugule, S., Tallej, T. (2019). Characteristic of Coconut Milk Powder Made by Variation of Coconut-Water Ratio, Concentration of Tween and Guar Gum. <i>J. Appl. Sci. Res</i>, 13(6), 34-44.</p> <p>18. Baser, K.H.C., Buchbauer, G. (2015). <i>Handbook of Essential Oils: Science, Technology, and Applications</i>. CRC Press.</p> <p>19. de Groot, A.C. (2016). <i>Essential Oils: Chemistry, Pharmacology, and Health Effects</i>. CRC Press.</p> <p>20. Lawrence, B.M. (2007). <i>Essential Oils: Analysis and Identification</i>. Allured Publishing.</p> <p>21. Guenther, E. (1972). <i>The Essential Oils. Volumes I-VI</i>. D. Van Nostrand Company.</p> <p>22. Smith, R.M. (2004). <i>Understanding Mass Spectra: A Basic Approach</i>. Wiley.</p>
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Catalysis Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30142766
Semester(s) in which the module is taught	<i>6th or 7th Semester</i>
Person responsible for the module	<i>Prof. Dr. Meytij Rampe, M.Si</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si; Miftahul Jannah, S.Si., M.Si; Soenandar Tengker, M.Sc</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Elective course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Chemical Kinetics</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the principles of catalysis and catalytic cycles. • Explain homogeneous, heterogeneous, enzymatic, and photocatalysis mechanisms. • Describe industrial and environmental applications of catalysis. <p>Skills</p> <ul style="list-style-type: none"> • Design catalytic experiments and evaluate

	<p>reaction kinetics.</p> <ul style="list-style-type: none"> • Apply spectroscopic and analytical methods to study catalysts. • Assess catalyst efficiency, selectivity, and sustainability. <p>Competences</p> <ul style="list-style-type: none"> • Integrate catalysis knowledge with green chemistry and industrial processes. • Demonstrate accuracy, reproducibility, and ethical responsibility in catalytic research. • Communicate catalytic findings effectively in scientific reports and presentations.
Content	<ul style="list-style-type: none"> • Introduction to catalysis and catalytic cycles • Homogeneous catalysis (organometallic complexes, acid-base catalysis) • Heterogeneous catalysis (surface chemistry, solid catalysts) • Enzyme catalysis and biocatalysis • Photocatalysis and electrocatalysis • Kinetics and thermodynamics of catalytic reactions • Catalyst design, characterization, and regeneration • Industrial applications (petrochemicals, pharmaceuticals, polymers, environmental remediation) • Case studies: transition metal catalysis, green catalytic processes
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<ol style="list-style-type: none"> 1. Gugule, S., Aloanis, A.A. (2020). <i>Mempelajari Reaksi Transesterifikasi Terkatalisis Kalsium Oksida. Fullerene Journal of Chemistry</i>, 5(2), 73-77. 2. Tarigan, R.Y.W.B., Gugule, S., Tuerah, J.M., Maanari, C. (2023). <i>Pengaruh Katalis Terhadap</i>

	<p><i>Rendemen Reaksi Transesterifikasi. Fullerene Journal of Chemistry</i>, 8(2), 65-72.</p> <ol style="list-style-type: none"> 3. Kosegeran, S.G.R., Gugule, S., Lombok, J.Z. (2021). <i>Sintesis Triacetin dari Gliserol dan Asam Asetat dengan Katalis Zeolit Alam Termodifikasi. Fullerene Journal of Chemistry</i>, 6(2), 155-160. 4. Fatimah, F., Gugule, S., Maanari, C.P., Tallei, T.E. (2020). <i>Data on the Use of Virgin Coconut Oil and Bioethanol Produced from Sugar Palm Sap as Raw Materials for Biodiesel Synthesis. Data in Brief</i>, 29, 105199. 5. Rampe, M.J., Lombok, J.Z., Tiwow, V.A., Tengker, S.M.T., Bua, J. (2023). <i>Characterization of Silica (SiO₂) Based on Beach Sand from Sulawesi and Sumatra as Silicon Carbide (SiC) Base Material. Journal of Chemical Technology and Metallurgy</i>, 58(3), 467-476. 6. Hegedus, L.S., McDaniel, M.P. (2014). <i>Catalysis</i>. Wiley. 7. Ertl, G., Knözinger, H., Weitkamp, J. (1997). <i>Handbook of Heterogeneous Catalysis</i>. Wiley-VCH. 8. Bhan, A., Iglesia, E. (2008). <i>Catalysis in Industrial Chemistry</i>. Elsevier. 9. Somorjai, G.A., Li, Y. (2010). <i>Introduction to Surface Chemistry and Catalysis</i>. Wiley. 10. Cornils, B., Herrmann, W.A. (2003). <i>Applied Homogeneous Catalysis with Organometallic Compounds</i>. Wiley-VCH.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Bioactive Compounds
Module level	<i>Bachelor (Undergraduate)</i>
Code	30142770
Semester(s) in which the module is taught	<i>6th or 7th Semester</i>
Person responsible for the module	<i>Dr. Anderson Aloanis, M.Si</i>
Lecturer	<i>Dr. Anderson Aloanis, M.Si; Dr. Emma J. Pongoh, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Elective course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Natural Product organic chemistry and food chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the classification and chemistry of bioactive compounds (alkaloids, flavonoids, terpenoids, peptides, saponins). • Explain biosynthetic pathways and mechanisms of bioactivity. • Describe applications of bioactive compounds in pharmaceuticals, nutraceuticals, and agrochemicals.

	<p>Skills</p> <ul style="list-style-type: none"> • Isolate and characterize bioactive compounds using chromatography and spectroscopy. • Conduct bioassays to evaluate biological activity (antioxidant, antimicrobial, anticancer). • Apply computational tools for structure-activity relationship (SAR) analysis. <p>Competences</p> <ul style="list-style-type: none"> • Integrate bioactive compound knowledge with drug discovery and sustainable development. • Demonstrate ethical responsibility in bioprospecting and biodiversity conservation. • Communicate findings effectively in scientific reports and presentations.
Content	<ul style="list-style-type: none"> • Introduction to bioactive compounds • Classification and structural diversity • Biosynthetic pathways and metabolic engineering • Isolation and purification techniques • Biological activity and pharmacological relevance • Case studies: anticancer, antimicrobial, antioxidant bioactive compounds • Bioactive peptides and protein hydrolysates
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<ol style="list-style-type: none"> 1. Aloanis, A.A., Paat, V.I., Duengo, S. (2026). Total Synthesis and Potential Bioactivity of Linear Peptide LSAVTPG. <i>Fullerene Journal of Chemistry</i>, 11(2), 86-93 2. Aloanis, A.A., Paat, V.I. (2025). <i>Peptida Antimikroba</i>. Penerbit Tahta Media. 3. Najoan, J.M.J., Rumampuk, R.J., Paat, V.I., Aloanis, A.A. (2025). <i>In Silico Study of the YAKRCFR Peptide Structure and Its Interaction with Human</i>

- Peroxiredoxin-5*. *Jurnal Beta Kimia*, 5(2), 1-8.
4. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). *Structural Design and Synthesis of Cycloenegalina A Analogue*. *Journal of Heterocyclic Chemistry*, 62(9), 781-790.
 5. Paat, V.I., Aloanis, A.A., Najooan, J.M.J. (2025). *Molecular Docking of Cycloenegalina A as Anticancer*. *Fullerene Journal of Chemistry*, 10(1), 26-33.
 6. Aloanis, A.A., Najooan, J.M.J., Paat, V.I., Rumengan, S.M., Rumampuk, R.J. (2025). *Total Synthesis and Molecular Docking Study of Peptide AWWDY as an Anti-inflammation Agent*. *JKPK (Jurnal Kimia dan Pendidikan Kimia)*, 10(2), 234-254.
 7. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2025). *Alanine-Rich Cyclopeptides: Natural Resources, Bioactivity, Total Synthesis, and Spectroscopy Identification*. *ChemistrySelect*, 10(1), e202404379.
 8. Aloanis, A.A., Herlina, T., Hardianto, A., Maharani, R. (2024). *Total Synthesis of Cycloenegalina A*. *ChemistryOpen*, 13(12), e202400175.
 9. Aloanis, A.A., Paat, V.I. (2024). *Buku Bahan Ajar Senyawa Bioaktif*. Penerbit Tahta Media.
 10. Aloanis, A.A., Paat, V.I. (2024). *Sintesis Siklopeptida*. Penerbit Tahta Media.
 11. Aloanis, A.A., Karundeng, M. (2021). *Antioxidant Properties of Beringin (Ficus benjamina Linn.) Fruit*. *Fullerene Journal of Chemistry*, 6(2), 165-170.
 12. Aloanis, A.A., Karundeng, M., Paat, V.I., Tengker, S.M.T., Siwu, O. (2021). *Sun Protecting Factor Value of the Ficus benjamina Linn. Fruits Extract*. *Journal of Physics: Conference Series*, 1968(1), 012009.
 13. Saputra, T.R., Purnamasari, E., Aloanis, A.A. (2019). *Isolasi Senyawa Flavonoid dari Tumbuhan Cocor Bebek sebagai Sediaan Inhibitor Korosi*. *Fullerene Journal of Chemistry*, 4(2), 72-75.
 14. Aloanis, A.A., Karundeng, M. (2019). *Total Kandungan Antioksidan Ekstrak Etanol Buah Beringin (Ficus benjamina Linn.)*. *Fullerene Journal of Chemistry*, 4(1), 1-4.
 15. Aloanis, A.A., Fahriana, Haryadi (2017). *Skrining Fitokimia dan Uji Toksisitas Ekstrak Daun Balik Angin (Mallotus sp.) terhadap Larva Artemia salina Leach dengan Metode Brine Shrimp Lethality Test (BSLT)*. *Fullerene Journal of Chemistry*, 2(2), 77-81.
 16. Herlina, T., Aloanis, A.A., Kurnia, D., Harneti, D., Maharani, R., Supratman, U. (2017). *Prenylated Isoflavanones from the Stem Bark of Erythrina poeppigiana (Leguminosae) and its Antimalarial Properties*. *Natural Product Communications*, 12(8), 1934578X1701200825.

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| | <ol style="list-style-type: none">17. Dewick, P.M. (2009). <i>Medicinal Natural Products: A Biosynthetic Approach</i>. Wiley.18. Cox, P.A. (1994). <i>The Elements of Natural Product Chemistry</i>. Wiley.19. Hanson, J.R. (2003). <i>Natural Products: The Secondary Metabolite</i>. Royal Society of Chemistry |
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Marine Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30142768
Semester(s) in which the module is taught	<i>6th or 7th Semester</i>
Person responsible for the module	<i>Prof. Dr. Feti Fatimah, M.Si</i>
Lecturer	<i>Prof. Dr. Feti Fatimah, M.Si, Jenny Kumajas, M.Si</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Elective course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>Food Chemistry and Environmental Impact Assessment Chemistry</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the chemical composition of seawater and marine sediments. • Explain biogeochemical cycles in marine environments (carbon, nitrogen, phosphorus, sulfur). • Describe pollution sources and chemical impacts on marine ecosystems. <p>Skills</p>

	<ul style="list-style-type: none"> • Perform sampling and analysis of seawater and marine sediments. • Apply spectroscopic and chromatographic techniques to marine samples. • Interpret chemical data in relation to oceanographic processes. <p>Competences</p> <ul style="list-style-type: none"> • Integrate marine chemistry knowledge with environmental monitoring and sustainability. • Demonstrate accuracy, reproducibility, and ethical responsibility in marine research. • Communicate findings effectively in scientific reports and presentations.
Content	<ul style="list-style-type: none"> • Introduction to marine chemistry and oceanography • Chemical composition of seawater (major ions, trace elements, gases) • Biogeochemical cycles in marine systems • Marine organic chemistry (lipids, proteins, carbohydrates in seawater) • Sediment chemistry and diagenesis • Marine pollution (heavy metals, oil spills, microplastics) • Analytical techniques for marine chemistry (ICP-MS, GC-MS, spectrophotometry) • Case studies: nutrient enrichment, acidification, coastal pollution • Marine chemistry and climate change
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C
Reading list	<p><i>Main References</i></p> <ol style="list-style-type: none"> 1. <i>Pilson, M.E.Q. (2013). An Introduction to the Chemistry of the Sea. Cambridge University Press.</i> 2. <i>Libes, S.M. (2009). Introduction to Marine Biogeochemistry. Wiley.</i> 3. <i>Chester, R., Jickells, T. (2012). Marine</i>

	<p><i>Geochemistry</i>. Wiley.</p> <ol style="list-style-type: none">4. Bruland, K.W., Lohan, M.C. (2003). <i>Controls of Trace Metals in Seawater</i>. Elsevier.5. Millero, F.J. (2006). <i>Chemical Oceanography</i>. CRC Press.
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Bachelor of Chemistry
MODULE HANDBOOK

Email : kimia@unima.ac.id

Website : <https://www.kimia.unima.ac.id>

Module designation	Coconut Chemistry
Module level	<i>Bachelor (Undergraduate)</i>
Code	30142769
Semester(s) in which the module is taught	<i>6th or 7th Semester</i>
Person responsible for the module	<i>Prof. Dr. Sanusi Gugule, M.S</i>
Lecturer	<i>Prof. Dr. Meytij Rampe, M.Si; Prof. Dr. Sanusi Gugule, M.S</i>
Language	<i>Indonesian/ English</i>
Relation to curriculum	<i>Elective course in the Chemistry Study Program</i>
Teaching methods	<i>Lecture, discussion, discovery learning, case-based learning, project based learning, online and offline sessions</i>
Workload	<i>45 hours x 2 credit points = 90 hours per semester</i>
Credit points	<i>2 credits (SKS)</i>
Required and recommended prerequisites for joining the module	<i>None</i>
Module objectives/intended learning outcomes	<p>Knowledge</p> <ul style="list-style-type: none"> • Understand the chemical composition of coconut (oil, water, shell, husk, milk). • Explain the physicochemical properties and bioactivity of coconut-derived compounds. • Describe industrial applications of coconut chemistry in food, cosmetics, and biofuels. <p>Skills</p> <ul style="list-style-type: none"> • Isolate and characterize coconut oil and

	<p>derivatives using chromatography and spectroscopy.</p> <ul style="list-style-type: none"> • Conduct transesterification and biodiesel synthesis from coconut oil. • Perform antioxidant and antimicrobial assays on coconut-based products. <p>Competences</p> <ul style="list-style-type: none"> • Integrate coconut chemistry with sustainable development and local resource utilization. • Demonstrate accuracy, reproducibility, and ethical responsibility in natural product research. • Communicate findings effectively in scientific reports and presentations.
Content	<ul style="list-style-type: none"> • Introduction to coconut chemistry and its economic importance • Chemical composition of coconut oil, milk, water, and shell • Extraction and purification techniques (cold press, solvent extraction, enzymatic methods) • Physicochemical properties of coconut oil and derivatives • Bioactive compounds in coconut (fatty acids, phenolics, antioxidants) • Transesterification and biodiesel production from coconut oil • Industrial applications (food, cosmetics, pharmaceuticals, biofuels) • Case studies: virgin coconut oil, coconut milk powder, biodiesel from coconut oil • Sustainability and ethical issues in coconut resource utilization
Examination forms	<i>Written examination (mid-term and final), quizzes, assignments, project presentation, portfolio, and attendance</i>
Study and examination requirements	<ul style="list-style-type: none"> - Attendance $\geq 80\%$ - Completion of all tasks and quizzes - Participation in discussions and projects - Mid-term exam (UTS) and Final exam (UAS) - Pass mark: minimum grade C

Reading list	<p>Main References</p> <ol style="list-style-type: none"> 1. Maanari, C.P., Gugule, S., Fatimah, F., Utami, A.R.P., Mustapa, M. (2023). Effect Of Potassium Hydroxide Concentration As A Catalyst On The Yield Of Coconut Oil (<i>Cocos nucifera</i>) Transesterification. <i>Indonesian Journal of Pure and Applied Chemistry</i>, 6(3), 142-150. 2. Gugule, S., Fatimah, F., Maanari, C.P., Tallei, T.E. (2020). Data on the Use of Virgin Coconut Oil and Bioethanol Produced from Sugar Palm Sap as Raw Materials for Biodiesel Synthesis. <i>Data in Brief</i>, 29, 105199. 3. Gugule, S., Maanari, C.P., Fatimah, F., Tani, D. (2020). Synthesis and Characterization of Biodiesel from Virgin Coconut Oil (VCO). 4. Fatimah, F., Gugule, S., Tallei, T. (2019). Characteristic of Coconut Milk Powder Made by Variation of Coconut-Water Ratio, Concentration of Tween and Guar Gum. <i>J. Appl. Sci. Res</i>, 13(6), 34-44. 5. Fatimah, F., Rorong, J., Gugule, S. (2012). Stabilitas dan Viskositas Produk Emulsi Virgin Coconut Oil-Madu. <i>Jurnal Teknologi dan Industri Pangan</i>, 23(1), 75-75. 6. Fatimah, F., Rorong, J., Gugule, S. (2012). Stability and Viscosity of Oil-Honey Virgin Coconut Oil Emulsion Product. <i>Journal of Technology and Food Sciences</i>, 23(1), 75-80. 7. • Fatimah, F., Gugule, S. (2012). Kualitas Emulsi Salad Dressing Berbahan Dasar Virgin Coconut Oil. <i>Agritech: Jurnal Fakultas Teknologi Pertanian UGM</i>, 31(2), 105143. 8. Gugule, S., Fatimah, F., Sam, U. (2012). Karakterisasi Virgin Coconut Oil (VCO) Rempah. <i>Chem. Prog</i>, 2, 104. 9. Rampe, M.J., Lombok, J.Z., Tiwow, V.A., Rampe, H.L., Garani, M. (2024). Surface Structure and Chemical Composition of Coconut Shell Charcoal Using Nira Aren (<i>Arenga pinnata</i>) Acid Activation. <i>Journal of Chemical Technology and Metallurgy</i>, 60(2), 269-274. 10. Slarmanat, R., Rampe, M.J., Lombok, J.Z. (2024). Sintesis SiC (Silikon Karbida) Berbahan Dasar Pasir Putih dan Arang Tempurung Kelapa. <i>Fullerene Journal of Chemistry</i>, 9(1), 21-25. 11. Rampe, M.J., Santoso, I.R.S., Rampe, H.L., Tiwow, V.A., Rorano, T.E.A. (2024). Study of Pore Length and Chemical Composition of Charcoal from Pyrolysis of Coconut Shell in Bolaang Mongondow, Sulawesi, Indonesia. <i>Karbala International Journal of Modern Science</i>, 8(1), 96-104. 12. Tiwow, V.A., Rampe, M.J., Rampe, H.L., Apita, A. (2024). Pola Inframerah Arang Tempurung Kelapa
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	<p>Hasil Pemurnian Menggunakan Asam. <i>Chemistry Progress</i>, 14(2), 116.</p> <p>13. Rampe, M.J., Santoso, I.R.S., Rampe, H.L., Tiwow, V.A., Apita, A. (2024). <i>Infrared Spectra Patterns of Coconut Shell Charcoal as Result of Pyrolysis and Acid Activation Origin of Sulawesi, Indonesia</i>. <i>E3S Web of Conferences</i>, 328, 08008.</p> <p>14. • Goni, A., Rampe, M.J., Kapahang, A., Turangan, T.M. (2023). <i>Making and Characterization of Active Carbon from Coconut Shell Charcoal</i>. <i>Int. J. Adv. Educ. Res</i>, 4, 40-43.</p> <p>15. Rampe, M.J., Tiwow, V.A. (2018). <i>Fabrication and Characterization of Activated Carbon from Charcoal Coconut Shell Minahasa, Indonesia</i>. <i>Journal of Physics: Conference Series</i>, 1028(1), 012033.</p> <p>16. Rampe, M.J., Bambang, S., Wega, T., Triyono, T. (2014). <i>Study on Growth of Carbon Crystal from Charcoal Obtained by Pyrolysis of Coconut Shell</i>. <i>Proceeding of International Conference on Research, Implementation and</i></p> <p>17. Rampe, J.M., Setiaji, B., Trisunaryanti, W. (2014). <i>Analisis Struktur Mikro dan Struktur Kristal Karbon Tempurung Kelapa dan Polivinil Alkohol (PVA) pada Temperatur Tinggi</i>. <i>Chemistry Progress</i>, 7(2).</p> <p>18. Rampe, M.J., Tiwow, V.A., Rampe, H.L. (2013). <i>Potensi Arang Hasil Pirolisis Tempurung Kelapa sebagai Material Karbon</i>. <i>Jurnal Sains, Matematika, dan Pembelajarannya (SAINSMAT)</i>, 2(2), 191-197.</p> <p>19. Rampe, M.J., Setiaji, B., Trisunaryanti, W. (2012). <i>The Production and Characterization of Carbon Composite from Coconut Shell Charcoal</i>. <i>CORD</i>, 28(1), 45-53.</p>
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