MODULE HANDBOOK

DOCTOR BIOLOGICAL SCIENCES STUDY PROGRAM

FACULTY OF BIOLOGY
UNIVERSITAS GADJAH MADA

THE MODULE HANDBOOK
DOCTOR BIOLOGICAL SCIENCES STUDY PROGRAM
FACULTY OF BIOLOGY

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FACULTY OF BIOLOGY
UNIVERSITAS GADJAH MADA

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DOCTOR BIOLOGICAL SCIENCES STUDY PROGRAM
FACULTY OF BIOLOGY

PHILOSOPHY OF SCIENCE

Course code	BIDB203101
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Budi S. Daryono, M.Agr.Sc.
Lecture(s)	Drs. Hari Purwanto, M.P., Ph.D. Prof. Dr. Budi S. Daryono, M.Agr.Sc. Rina Sri Kasiamdari, S.Si., Ph.D. Dr. Eko Agus Suyono, S.Si., M.App.Sc. Dr. Bambang Retnoaji, M.Sc. Zuliyati Rohmah, S.Si., M.Si., Ph.D.Eng.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1.125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3.6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 2.1. Upon completing this program, the graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems.

	CPL 3.5. After completing this program, the graduates will be able to demonstrate academic leadership and increase independent learning capacity; CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB203101.1 By the end of this course, students will be able to understand the fundamental concepts of philosophy and the philosophy of science. BIDB203101.2 By the end of this course, students will be able to analyze the correlation between philosophy and the development of science. BIDB203101.3 By the end of this course, students will be able to develop the ability to think critically about the fundamental assumptions and scientific models BIDB203101.4 By the end of this course, students will be able to integrate ethics, honesty, and dignity into science. BIDB203101.5 By the end of this course, students will be able to design scientific research based on philosophy of science
Course Description	This course provides a comprehensive examination of the principles of the philosophy of science, the correlation between science, philosophy, and scientific methodology, as well as the philosophical underpinnings that have shaped the development of scientific knowledge. Students will engage with core concepts in the philosophy of science, including the fundamental assumptions of scientific inquiry, modes of scientific reasoning, the relationship between scientific laws and theories, and the correlation of ethics and science. The course further underscores the significance of integrating core values such as honesty, dignity, and ethical responsibility into science.

Assessments	The assessment for Philosophy of Science is based on two main components, with the respective criteria and weights: A. Participatory Activity (55%) • Structured Assignment/Task (10%) • Mid-term Examination (10%) • Final-term Examination (10%) • Participation (25%) B. Project (45%) • Structured Assignment/Task (10%) • Quizzes (5%) • Project Result (30%)
Study Media and Literature	• Any journals, books and articles related to philosophy of science topic

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DOCTOR BIOLOGICAL SCIENCES STUDY PROGRAM
FACULTY OF BIOLOGY

RESEARCH METHODOLOGY AND SCIENTIFIC WRITING

Course code	BIDB203101
Course level	Doctoral Program (Reguler Program)
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Budi S. Daryono, M.Agr.Sc.
Lecture(s)	Prof. Dr. Budi S. Daryono, M.Agr.Sc. Zuliyati Rohmah, S.Si., M.Si., Ph.D.Eng.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1.125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3.6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.2.Upon completing this program, the graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.3.Upon completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism. CPL 4.1. Upon completing this program, the graduates will be able to deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach;

	CPL 4.2. Upon completing this program, the graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction. CPL 4.3. Upon completing this program, the graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment
Course Learning Outcome	BIDB203102.1 By the end of this course, students will be able to analyze the development of science and technology and its implications for contemporary research trends. BIDB203102.2 By the end of this course, students will be able to formulate complex and relevant research issues in the fields of science, technology, and biomedicine. BIDB203102.3 By the end of this course, students will be able to develop an innovative research proposal that incorporates considerations of biomedical ethics and scientific publication standards. BIDB203102.4 By the end of this course, students will be able to implement appropriate research methods to obtain valid and reliable data. BIDB203102.5 By the end of this course, students will be able to evaluate research findings and write them in a report that meets academic standards and publication ethics. BIDB203102.6 By the end of this course, students will be able to identify and evaluate ethical issues in biomedical research as well as intellectual property rights (IPR). BIDB203102.7 By the end of this course, students will be able to publish the research findings in reputable scientific journals by adhering to international publication ethics standards. BIDB203102.8 By the end of this course, students will be able to prepare and present articles or press releases related to research by integrating effective scientific communication skills. BIDB203102.9 By the end of this course, students will be able to evaluate innovations in research related to the industrial revolution and their impact on modern research methods.

Course Description	This course provides an understanding of research methodology and scientific writing in the fields of science and technology, with a focus on research ethics, innovation, and scientific publication. Students will learn the process of preparing proposals, conducting research, reporting research findings, and publishing in scientific journals. Additionally, aspects of biomedical ethics and Intellectual Property Rights (IPR) are discussed as essential components of modern research.
Assessments	The assessment for Research Methodology and Scientific Writing is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Structured Assignment/Task (10%) • Participation (10%) B. Project (80%) • Structured Assignment/Task (20%) • Project Result (60%)
Study Media and Literature	• Dissertation writing guidebook • Any journals, books and articles related to topic

COMPREHENSIVE EXAMINATION

Course code	BIDB203201
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 weeks/semester for preparation and 2 weeks of examination.
Workload	5,72 hours/day 5 days/week 28,59 hours/week 16 Weeks/Semester total workload : 457,5 hours/18,3 ECTS
Credits	4 SKS/18,3 ECTS
Requirements	Passing all required courses in selected topic for dissertation.
Program Learning Outcome	CPL 1.3. Upon completing this program, the graduates demonstrate an attitude of being able to internalize academic values,norms and ethics CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development. CPL 2.3. After attending this program, graduates demonstrate an understanding of new concepts in the fields of biology and applied biology. CPL 3.4. After completing this program, the graduates will be able to communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community.

	CPL 4.1. After participating in this program, graduates will be able to deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach. CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction.
Course Learning Outcome	BIDB203201.1 By the end of this course, students will be able to Break down complex theories and concepts in their field to evaluate their relevance and application to research problems. BIDB203201.2 By the end of this course, students will be able to Critically assess methodologies, frameworks, and scientific literature to determine their suitability for addressing specific research questions. BIDB203201.3 By the end of this course, students will be able to Integrate knowledge from various disciplines to develop innovative approaches or solutions to advanced problems in their field. BIDB203201.4 By the end of this course, students will be able to Utilize advanced concepts and research principles to construct arguments or solve problems presented during the examination. BIDB203201.5 By the end of this course, students will be able to Justify their research direction and conceptual understanding during oral or written components of the comprehensive examination.
Course Description	The Ujian Komprehensif/comprehensive examination is a critical assessment designed to evaluate a doctoral student's mastery of core knowledge in their field of study, as well as their readiness to proceed with dissertation research. This examination tests the student's understanding of fundamental theories, methodologies, and research frameworks related to their discipline. Success in this test demonstrates the student's ability to integrate and apply knowledge at an advanced level, marking an important milestone in their doctoral journey.

Assessments	The assessment for Comprehensive Examination is based on two components, with the respective criteria and weights: 1. Participatory Activity (40%) 2. Project/Case Study/PBL Result (60%)
Study Media and Literature	● Any journals dan books related to dissertation topic

SCIENTIFIC CONFERENCE

Course code	BIDB203202
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Student Centered Learning: Learning through discussion and presentation
Workload	4,28 hours/day 5 days/week 21,41 hours/week 16 Weeks/Semester total workload : 342,5 hours/13,7 ECTS
Credits	3-0 credits / 13.7 ECTS
Requirements	Passing Research Methodology and Scientific Writing Course.
Program Learning Outcome	CPL 2.2.Upon completing this program, the graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 2.3.Upon completing this program, the graduates will be able to demonstrate an understanding of new concepts in the fields of biology and applied biology. CPL 3.5. Upon completing this program, the graduates will be able to demonstrate academic leadership and increase independent learning capacity
Course Learning Outcome	BIDB203202.1 By the end of this course, students will be able to understand theoretical biology concepts, especially those related to their dissertation research theme.

	BIDB203202.2 By the end of this course, students will be able to possess effective scientific presentation skills. BIDB203202.3 By the end of this course, students will be able to communicate verbally in an international language.
Course Description	Mandatory participation in international or national conferences as a participant or presenter. Credit value per scientific conference: 0.5 credits for national seminars and 1 credit for international seminars. Requirement: Submission of seminar participation report and certificate. (Attending an international seminar as a presenter earns an A grade; as a participant, an A or B grade; attending a national seminar as a presenter earns an A- grade; as a participant, an A or B grade.)
Assessments	The assessment for Scientific Conference is based on participatory activity, with the respective criteria and weights: • Stuctured Assigment/Task (20%) • Participation (80%)
Study Media and Literature	• https://simaster.ugm.ac.id • Blackwell, J., and J. Martin. 2011. A Scientific Approach to Scientific Writing. Springer. New York.

DISSERTATION RESEARCH I

Course code	BIDB203301
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Project Based Learning
Workload	2 hours/day 5 days/week 10 hours/week 16 Weeks/Semester total workload : 160 hours/6,4 ECTS
Credits	0-2 credits/6.4 ECTS
Requirements	Passing the comprehensive exam and conducting research after discussion with the Promoter team.
Program Learning Outcome	CPL 2.2. Upon completing this program, the graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development. CPL 2.3. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner; CPL 3.3. After completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism

Course Learning Outcome	BIDB203301.1 By the end of this course, students will be able to conduct dissertation research based on scientific principles. BIDB203301.2 By the end of this course, students will be able to prepare a research report based on scientific principles. BIDB203301.3 By the end of this course, students will be able to communicate verbally in an international language BIDB203301.4 By the end of this course, students will be able to solve problems encountered during the dissertation research process.
Course Description	This course involves the implementation of dissertation research. Students carry out their dissertation research following discussions with the advisory team. Assessment for this course is conducted through progress report presentations.
Assessments	The assessment for Dissertation Research I is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) B. Project Result (80%)
Study Media and Literature	● https://simaster.ugm.ac.id/ ● Blackwell, J., and J. Martin. 2011. A Scientific Approach to Scientific Writing. Springer. New York.

PUBLICATION

Course code	BIDB203302
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	-
Workload	8 hours/day 5 days/week 40 hours/week 16 Weeks/Semester
Credits	8 Credits / 25,6 ECTS
Requirements	Passing Scientific Conference

Program Learning Outcome	CPL 1.1. contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 1.2.Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 3.2. contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology CPL 3.4. communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community CPL 3.5. After completing this program, the graduates will be able to demonstrate academic leadership and increase independent learning capacity;
Program Learning Outcome	CPL 4.1. deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach CPL 4.2. propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.

Course Learning Outcome	BIDB203302.1 By the end of this course, students will be able to demonstrate an understanding of the fundamental principles of effective scientific writing appropriate for reputable international journals. BIDB203302.2 By the end of this course, students will be able to Develop high-quality scientific manuscripts based on research findings that meet the standards for submission to reputable international journals. BIDB203302.3 By the end of this course, students will be able to formulate and implement writing and publication strategies in alignment with the standards and expectations of the international scientific community BIDB203302.4 By the end of this course, students will be able to communicate effectively with editors and reviewers from diverse cultural and academic backgrounds.
Course Description	This course is designed to prepare doctoral students for writing and publishing scholarly articles in reputable international journals. It covers key aspects of scientific writing strategies, appropriate journal selection, the submission and peer-review process, publication ethics, and the management of copyright and licensing. Students will be trained to develop effective writing skills and to respond to reviewers' feedback with the goal of increasing the likelihood of manuscript acceptance for publication.

Assessments	PUBLICATION CRITERIA FOR DOCTORAL PROGRAM Doctoral students are required to publish part or all of their dissertation manuscripts in recognized scientific journals. This publication is a graduation requirement and will be assessed based on the quality and reputation of the journal where the publication is made. Below are the detailed assessment criteria for publications: 1. International Publications with High Impact Factor: • Criteria: The dissertation manuscript is published in an international journal with a high impact factor (IF ≥ 5) and ranked in the first quartile (Q1) based on Scopus or Clarivate Analytics (Journal Citation Reports). • Assessment: Receives the highest rating. • Excellence: Publication in these journals indicates that the research has significant impact and is widely recognized by the international scientific community. It reflects high research quality and significant contributions to scientific advancement. • Journal Examples: Nature, Science, Cell, The Lancet. 2. International Publications with Medium Impact Factor: • Criteria: The dissertation manuscript is published in an international journal with a moderate impact factor (3 ≤ IF < 5) that is ranked in the second quartile (Q2) or third quartile (Q3) based on Scopus or Clarivate Analytics. • Assessment: Receives a high rating. • Excellence: Indicates that the research is relevant and recognized by the international scientific community. This publication is still considered high quality and provides significant contributions to specific fields of study. • Journal Examples: PLOS ONE, Journal of Biological Chemistry, BMC Biology. 3. International Publications with Low Impact Factor or Journals Without IF Ranking: • Criteria: The dissertation manuscript is published in an international journal that does not have an impact factor or is ranked in the fourth quartile (Q4) based on Scopus or Clarivate Analytics. • Assessment: Receives a medium rating. • Excellence: Indicates that the research has reached the international scientific community, although it may not hav a significant impact. These journals still have rigorous peer review standards. • Journal Examples: Niche or regional international journals.

4. Publications in Accredited National Journals:

- Criteria: The dissertation manuscript is published in a nationally accredited journal recognized by the Directorate General of Higher Education or other journals recognized as high quality by experts in the Biology Study Program.
- Assessment: Receives a medium to low rating.
- Excellence: Indicates the relevance of research in the national context and is recognized by the national scientific community. This publication still demonstrates an important contribution to national scientific knowledge, even if its international impact is limited.
- Journal Examples: Indonesian Journal of Biology, Journal of Science and Technology.

Evaluation Process and Graduation Honors Determination:

At the latest, one month before the graduation date, a Judicium Meeting is held, attended by the Supervisory Team, Doctoral Program Coordinator, and Graduate Program Management. In this meeting, the quality of publications will be evaluated based on the above criteria to determine the graduation honors of the doctoral student:

1. **A**: Publication in high-impact international journals (IF ≥ 5) or multiple publications in international journals with medium impact factor (3 ≤ IF < 5). Publication in international journals with medium impact factor (3 ≤ IF <

   5) or consistently in Q3/Q4 journals.

2. **A-**: Publication in highly accredited national journals or a combination of publications in national and international journals with low impact factor.

3. **B**: Publication in low accredited national journals or a combination of publications in national and international journals with very low impact factor.

Study Media and Literature	1. Day, R.A., & Gastel, B. (2016). How to Write and Publish a Scientific Paper. Cambridge University Press. 2. Cargill, M., & O'Connor, P. (2013). Writing Scientific Research Articles: Strategy and Steps. Wiley-Blackwell. 3. Committee on Publication Ethics (COPE). Guidelines on Good Publication Practice. Evaluation Process and Graduation Honors Determination: At the latest, one month before the graduation date, a Judicium Meeting is held, attended by the Supervisory Team, Doctoral Program Coordinator, and Graduate Program Management. In this meeting, the quality of publications will be evaluated based on the above criteria to determine the graduation honors of the doctoral student: 1. A: Publication in high-impact international journals (IF ≥ 5) or multiple publications in international journals with medium impact factor (3 ≤ IF < 5). Publication in international journals with medium impact factor (3 ≤ IF < 5) or consistently in Q3/Q4 journals. 2. A-: Publication in highly accredited national journals or a combination of publications in national and international journals with low impact factor. 3. B: Publication in low accredited national journals or a combination of publications in national and international journals with very low impact factor. With these criteria, it is expected that doctoral program students will be motivated to produce high-quality research that can make significant contributions to both international and national scientific communities.

DISSERTATION RESEARCH II

Course code	BIDB203401
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Research based learning This course is planned to have 16 weeks/semester for preparation and 2 weeks of examination.
Workload	10 hours/day 5 days/week 50 hours/week 16 Weeks/Semester total workload : 800 hours/32 ECTS
Credits	32 ECTS
Requirements	Passing the Dissertation research I.
Program Learning Outcome	CPL 3.3. Upon completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism.
Course Learning Outcome	BIDB203401.1 By the end of the Research II course, students will be able to critically evaluate and interpret data collected during the research process to identify patterns, insights, and anomalies relevant to their dissertation. BIDB203401.2 By the end of the Research II course, students will be able to Assess the validity and reliability of research

	methodologies and results, making informed decisions to refine or adjust approaches. BIDB203401.3 By the end of the Research II course, students will be able to develop comprehensive scientific arguments and innovative solutions to address complex research challenges in their field of study. BIDB203401.4 By the end of the Research II course, students will be able to Integrate findings with existing scientific literature to contribute original knowledge to the field.
Course Description	This course is a continuation of Penelitian I, focusing on the advanced stages of dissertation research. Students deepen their research activities, analyze findings, and refine their methodologies based on progress achieved in Penelitian I. The course emphasizes critical evaluation of results, advanced problemsolving, and preparation for dissertation completion. Assessment is conducted through a comprehensive progress report presentation, demonstrating readiness for final research stages and contributions to scientific knowledge.
Assessments	The assessment for Dissertation Research II is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Participation (20%). B. Project (80%) • Project Resut (80%)
Study Media and Literature	● Any journals related to research topic

DISSERTATION RESEARCH III

Course code	BIDB203502
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Research based learning This course is planned to have 16 weeks/semester for preparation and 2 weeks of examination.
Workload	10 hours/day 5 days/week 50 hours/week 16 Weeks/Semester total workload : 800 hours/32 ECTS
Credits	32 ECTS
Requirements	Passing the Dissertation research II.
Program Learning Outcome	CPL 3.3. Upon completing this program, the graduates will be able to managing and formulating valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism. CPL 3.5. After completing this program, the graduates will be able to able to demonstrate academic leadership and increase independent learning capacity
Course Learning Outcome	BIDB203501.1 By the end of this course, students will be able to critically examine and integrate complex data to draw meaningful conclusions for their dissertation. BIDB203501.2 By the end of this course, students will be able to Assess the overall quality, validity, and impact of

	their research findings to ensure alignment with scientific standards. BIDB203501.3 By the end of this course, students will be able to develop a comprehensive dissertation document that contributes original knowledge to their field. BIDB203501.4 By the end of this course, students will be able to combine insights from research findings with existing literature to propose new theories, solutions, or advancements.
Course Description	This course serves as the final phase of dissertation research, building on the progress made in Penelitian I and Penelitian II. Students focus on completing their research, conducting advanced data analysis, and finalizing their findings. Emphasis is placed on synthesizing results, writing the dissertation, and preparing for the defense. The course ensures that students achieve a high standard of scientific rigor and make a significant contribution to their field of study.
Assessments	The assessment for Dissertation Research III is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Participation (20%). B. Project (80%) • Project Resut (80%)
Study Media and Literature	• Any journals and books related to research topic

DISSERTATION APPROPRIATENESS

Course code	BIDB203601
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 16 weeks/semester for preparation and 2 weeks of examination.
Workload	2,28 hours/day 5 days/week 11,406 hours/week 16 Weeks/Semester total workload : 182,5 hours/7,3 ECTS
Credits	7.3 ECTS
Requirements	Passing the Dissertation Research III
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila. CPL 1.3. Upon completing this program, the graduates demonstrate an attitude of being able to internalize academic values, norms and ethics. CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology.

	CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction.
Course Learning Outcome	BIDB203601.1 By the end of this course, students will be able to critically evaluate the strengths and weaknesses of their dissertation framework, methodology, and preliminary results.. BIDB203601.2 By the end of this course, students will be able to effectively present and justify their research approach and findings to a panel of experts. BIDB203601.3 By the end of this course, students will be able to incorporate feedback from evaluations to improve the quality and feasibility of their dissertation. BIDB203601.4 By the end of this course, students will be able to showcase readiness for the final dissertation phase by meeting academic and scientific standards.
Course Description	This course focuses on assessing the feasibility and academic quality of the student's dissertation work. Students submit their research framework, methodologies, and preliminary findings to a review panel to evaluate the readiness and potential of their dissertation for completion. The course aims to ensure the research aligns with scientific standards, demonstrates originality, and contributes to the field. Successful evaluation marks a significant milestone toward finalizing the dissertation.
Assessments	The assessment for Dissertation Appropriateness is based on two main components, with the respective criteria and weights: A. Participatory Activity (10%) • Participation (10%). B. Project (90%) • Project Resut (90%)
Study Media and Literature	• Dissertation writing guidebook • Any journals dan books related to dissertation topic

DISSERTATION FINAL EXAM

Course code	BIDB203602
Course level	Doctoral Program (Reguler)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 16 weeks/semester for preparation and 2 weeks of examination.
Workload	7,68 hours/day 5 days/week 38,437 hours/week 16 Weeks/Semester total workload : 615 hours/24,6 ECTS
Credits	24.6 ECTS
Requirements	Passing the Dissertation Appropriateness
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila. CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner; CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology

	CPL 3.4. After completing this program, the graduates will be able to communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community CPL 3.5. After completing this program, the graduates will be able to able to demonstrate academic leadership and increase independent learning capacity CPL 4.1. After participating in this program, graduates will be able to deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB203602.1 By the end of this course, students will be able to critically evaluate the strengths and weaknesses of their research methodology, data, and findings during the defense. BIDB203602.2 By the end of this course, students will be able to assess the significance, originality, and contribution of their research to the academic field. BIDB203602.3 By the end of this course, students will be able to synthesize their dissertation into a compelling, well-structured defense presentation that highlights the research impact BIDB203602.4 By the end of this course, students will be able to articulate and justify their research decisions, methodology, and conclusions with clarity and logical reasoning. BIDB203602.5 By the end of this course, students will be able to respond effectively to critical questions and feedback, demonstrating comprehensive mastery of their subject matter.
Course Description	the final examination for doctoral students, where they defend their completed dissertation before a panel of experts. This course evaluates the student's ability to present, justify, and critically

	discuss their research findings, methodology, and contribution to the field. The assessment focuses on the originality, rigor, and significance of the dissertation, marking the culmination of the doctoral journey and the attainment of academic excellence.
Assessments	The assessment for Dissertation is based on two main components, with the respective criteria and weights: A. Dissertation Quality (50%) • Content: Background, research problems, and objectives (20%). • Research Methods: Appropriateness and rigor of the research methodology (15%). • Research Structure: Organization and systematic approach of the dissertation (10%). • Language and Writing Style: Clarity, grammar, and adherence to academic standards (5%). B. Performance During the Examination (50%) • Mastery of Content: Depth of understanding and ability to explain the research (25%). • Command of Research Methods and Reasoning: Ability to justify methodologies, logical reasoning, and coherence in formulating arguments and conclusions (25%).
Study Media and Literature	• Dissertation writing guidebook • Any journals dan books related to dissertation topic

MODULE HANDBOOK
BY RESEARCH

FACULTY OF BIOLOGY
UNIVERSITAS GADJAH MADA

PHYLOSOPHY OF SCIENCE

Course code	BIDB203102
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Budi S. Daryono, M.Agr.Sc.
Lecture(s)	Drs. Hari Purwanto, M.P., Ph.D. Prof. Dr. Budi S. Daryono, M.Agr.Sc. Rina Sri Kasiamdari, S.Si., Ph.D. Dr. Eko Agus Suyono, S.Si., M.App.Sc. Dr. Bambang Retnoaji, M.Sc. Zuliyati Rohmah, S.Si., M.Si., Ph.D.Eng.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1.125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3.6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.3. After attending this program, graduates demonstrate an understanding of new concepts in the fields of biology and applied biology; CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing

	biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB203101.1 By the end of this course, students will be able to understand the fundamental concepts of philosophy and the philosophy of science. BIDB203101.2 By the end of this course, students will be able to analyze the correlation between philosophy and the development of science. BIDB203101.3 By the end of this course, students will be able to develop the ability to think critically about the fundamental assumptions and scientific models BIDB203101.4 By the end of this course, students will be able to integrate ethics, honesty, and dignity into science. BIDB203101.5 By the end of this course, students will be able to design scientific research based on philosophy of science
Course Description	This course provides a comprehensive examination of the principles of the philosophy of science, the correlation between science, philosophy, and scientific methodology, as well as the philosophical underpinnings that have shaped the development of scientific knowledge. Students will engage with core concepts in the philosophy of science, including the fundamental assumptions of scientific inquiry, modes of scientific reasoning, the relationship between scientific laws and theories, and the correlation of ethics and science. The course further underscores the significance of integrating core values such as honesty, dignity, and ethical responsibility into science.
Assessments	The assessment for Phylosophy of Science is based on two main components, with the respective criteria and weights: A. Participatory Activity (40%) • Mid-term Examination (10%) • Final-term Examination (10%) • Participation (20%) B. Project (60%) • Project/Case Study/Project Based Learning Result (60%)
Study Media and Literature	• Any journals, books and articles related to phylosophy of science topic

RESEARCH METHODOLOGY AND SCIENTIFIC WRITING

Course code	BIDB203101
Course level	Doctoral Program (By Research Program)
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Budi S. Daryono, M.Agr.Sc.
Lecture(s)	Prof. Dr. Budi S. Daryono, M.Agr.Sc. Zuliyati Rohmah, S.Si., M.Si., Ph.D.Eng.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1.125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3.6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.2.Upon completing this program, the graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.3.Upon completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism. CPL 4.1. Upon completing this program, the graduates will be able to deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach; CPL 4.2. Upon completing this program, the graduates will be able to propose new solutions or recommend proposed

	solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction. CPL 4.3. Upon completing this program, the graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment
Course Learning Outcome	BIDB203102.1 By the end of this course, students will be able to analyze the development of science and technology and its implications for contemporary research trends. BIDB203102.2 By the end of this course, students will be able to formulate complex and relevant research issues in the fields of science, technology, and biomedicine. BIDB203102.3 By the end of this course, students will be able to develop an innovative research proposal that incorporates considerations of biomedical ethics and scientific publication standards. BIDB203102.4 By the end of this course, students will be able to implement appropriate research methods to obtain valid and reliable data. BIDB203102.5 By the end of this course, students will be able to evaluate research findings and write them in a report that meets academic standards and publication ethics. BIDB203102.6 By the end of this course, students will be able to identify and evaluate ethical issues in biomedical research as well as intellectual property rights (IPR). BIDB203102.7 By the end of this course, students will be able to publish the research findings in reputable scientific journals by adhering to international publication ethics standards. BIDB203102.8 By the end of this course, students will be able to prepare and present articles or press releases related to research by integrating effective scientific communication skills. BIDB203102.9 By the end of this course, students will be able to evaluate innovations in research related to the industrial revolution and their impact on modern research methods.
Course Description	This course provides an understanding of research methodology and scientific writing in the fields of science and technology, with a focus on research ethics, innovation, and scientific publication. Students

	will learn the process of preparing proposals, conducting research, reporting research findings, and publishing in scientific journals. Additionally, aspects of biomedical ethics and Intellectual Property Rights (IPR) are discussed as essential components of modern research.
Assessments	The assessment for Research Methodology and Scientific Writing is based on two main components, with the respective criteria and weights: A. Participatory Activity (10%) • Participation (10%) B. Project (90%) • Stuctured Assigment/Task (20%) • Project Result (70%)
Study Media and Literature	● Dissertation writing guidebook ● Any journals, books and articles related to topic

COMPREHENSIVE EXAMINATION

Course code	BIDB203201
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 weeks/semester for preparation and 2 weeks of examination.
Workload	3,53 hours/day 5 days/week 17,65 hours/week 16 Weeks/Semester total workload : 282,5 hours/11,3 ECTS
Credits	2 SKS/11,3 ECTS
Requirements	Passing all required courses in selected topic for dissertation
Program Learning Outcome	CPL 1.3. Upon completing this program, the graduates demonstrate an attitude of being able to internalize academic values,norms and ethics CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development. CPL 2.3. After attending this program, graduates demonstrate an understanding of new concepts in the fields of biology and applied biology. CPL 3.4. After completing this program, the graduates will be able to communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community.

	CPL 4.1. After participating in this program, graduates will be able to deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach. CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction.
Course Learning Outcome	BIDB203201.1 By the end of this course, students will be able to Break down complex theories and concepts in their field to evaluate their relevance and application to research problems. BIDB203201.2 By the end of this course, students will be able to Critically assess methodologies, frameworks, and scientific literature to determine their suitability for addressing specific research questions. BIDB203201.3 By the end of this course, students will be able to Integrate knowledge from various disciplines to develop innovative approaches or solutions to advanced problems in their field. BIDB203201.4 By the end of this course, students will be able to Utilize advanced concepts and research principles to construct arguments or solve problems presented during the examination. BIDB203201.5 By the end of this course, students will be able to Justify their research direction and conceptual understanding during oral or written components of the comprehensive examination.
Course Description	The Ujian Komprehensif/comprehensive examination is a critical assessment designed to evaluate a doctoral student's mastery of core knowledge in their field of study, as well as their readiness to proceed with dissertation research. This examination tests the student's understanding of fundamental theories, methodologies, and research frameworks related to their discipline. Success in this test demonstrates the student's ability to integrate and apply knowledge at an advanced level, marking an important milestone in their doctoral journey.

Assessments	The assessment for Comprehensive Examination is based on two components, with the respective criteria and weights: 1. Participatory Activity (40%) 2. Project/Case Study/PBL Result (60%)
Study Media and Literature	● Any journals dan books related to dissertation topic

SCIENTIFIC CONFERENCE

Course code	BIDB203202
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Student Centered Learning: Learning through discussion and presentation
Workload	3,53 hours/day 5 days/week 17,65 hours/week 16 Weeks/Semester total workload : 282,5 hours/11,3 ECTS
Credits	3-0 credits / 11.3 ECTS
Requirements	Passing Publication I Course
Program Learning Outcome	CPL 2.2.Upon completing this program, the graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 2.3.Upon completing this program, the graduates will be able to demonstrate an understanding of new concepts in the fields of biology and applied biology. CPL 3.5. Upon completing this program, the graduates will be able to demonstrate academic leadership and increase independent learning capacity
Course Learning Outcome	BIDB203202.1 By the end of this course, students will be able to understand theoretical biology concepts, especially those related to their dissertation research theme. BIDB203202.2 By the end of this course, students will be able to possess effective scientific presentation skills.

	BIDB203202.3 By the end of this course, students will be able to communicate verbally in an international language.
Course Description	Mandatory participation in international or national conferences as a participant or presenter. Credit value per scientific conference: 0.5 credits for national seminars and 1 credit for international seminars. Requirement: Submission of seminar participation report and certificate. (Attending an international seminar as a presenter earns an A grade; as a participant, an A or B grade; attending a national seminar as a presenter earns an A- grade; as a participant, an A or B grade.)
Assessments	The assessment for Scientific Conference is based on participatory activity, with the respective criteria and weights: • Stuctured Assigment/Task (20%) • Participation (80%)
Study Media and Literature	• https://simaster.ugm.ac.id • Blackwell, J., and J. Martin. 2011. A Scientific Approach to Scientific Writing. Springer. New York.

DISSERTATION RESEARCH I

Course code	BIDB203301
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Research based learning This course is planned to have 16 weeks/semester for preparation and 2 weeks of examination.
Workload	7,09 hours/day 5 days/week 35,47 hours/week 16 Weeks/Semester total workload : 567,5 hours/22,7 ECTS
Credits	4 SKS/ 22.7 ECTS
Requirements	Passing the comprehensive exam.
Program Learning Outcome	CPL 2.1. After attending this program, graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems CPL 3.3. After completing this program, the graduates will be able to managing and formulating valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism CPL 4.1. After participating in this program, graduates will be able to deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an

	interdisciplinary, multidisciplinary or transdisciplinary approach; CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction
Course Learning Outcome	BIDB203204.1 By the end of this course, student will be able to Mastery of advanced research methodologies in the student's field of study. BIDB203204.2 By the end of this courses, students will be able to to design and implement experiments or studies that address key scientific questions. BIDB203204.3 By the end of this course, the students will be able to have competence in presenting research progress and responding to constructive feedback..
Course Description	The Research I course aims to monitor and guide students in conducting the initial stages of their dissertation research, as outlined in the approved proposal. Students will focus on collecting and analyzing preliminary data according to the established methodology. Discussions in this course include strategies for data collection, the application of statistical or qualitative analysis methods, and the interpretation of preliminary research findings. The course also supports students in preparing to publish their initial research results in scientific journals.
Assessments	The assessment for Dissertation Research I is based on two main components, with the respective criteria and weights: A. Participatory Activity (30%) • Structured Asignment/Task (20%) • Participation (10%). B. Project (70%) • Project Result (80%)
Study Media and Literature	• Research methodology books relevant to the student's field of study • Recent scientific articles related to the research topic • International journals targeted for research publication

PUBLICATION I

Course code	BIDB203302
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter
Language	Indonesian/English
Classification within	Compulsory
Teaching format/ class hours per week during	-
Workload	6,375 hours/day 5 days/week 31,875 hours/week
Credits	6 credits / 20.4 ECTS
Requirements	Passing Dissertation-research I
Program Learning Outcome	CPL 1.1. contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 1.2.Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 3.2. contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in
	CPL 4.1. deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach CPL 4.2. propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary

Course Learning Outcome	BIDB203304.1 By the end of this course, students will be able to demonstrate an understanding of the fundamental principles of effective scientific writing appropriate for reputable international journals. BIDB203304.2 By the end of this course, students will be able to Develop high-quality scientific manuscripts based on research findings that meet the standards for submission to reputable international journals. BIDB203304.3 By the end of this course, students will be able to formulate and implement writing and publication strategies in alignment with the standards and expectations of the international scientific community BIDB203304.4 By the end of this course, students will be able to communicate effectively with editors and reviewers from diverse cultural and academic backgrounds.
Course Description	This course is designed to prepare doctoral students for writing and publishing scholarly articles in reputable international journals. It covers key aspects of scientific writing strategies, appropriate journal selection, the submission and peer-review process, publication ethics, and the management of copyright and licensing. Students will be trained to develop effective writing skills and to respond to reviewers' feedback with the goal of increasing the likelihood of manuscript acceptance for publication.

Assessments	PUBLICATION CRITERIA FOR DOCTORAL PROGRAM Doctoral students are required to publish part or all of their dissertation manuscripts in recognized scientific journals. This publication is a graduation requirement and will be assessed based on the quality and reputation of the journal where the publication is made. Below are the detailed assessment criteria for publications: 1. International Publications with High Impact Factor: • Criteria: The dissertation manuscript is published in an international journal with a high impact factor (IF ≥ 5) and ranked in the first quartile (Q1) based on Scopus or Clarivate Analytics (Journal Citation Reports). • Assessment: Receives the highest rating. • Excellence: Publication in these journals indicates that the research has significant impact and is widely recognized by the international scientific community. It reflects high research quality and significant contributions to scientific advancement. • Journal Examples: Nature, Science, Cell, The Lancet. 2. International Publications with Medium Impact Factor: • Criteria: The dissertation manuscript is published in an international journal with a moderate impact factor (3 ≤ IF <5) that is ranked in the second quartile (Q2) or third quartile (Q3) based on Scopus or Clarivate Analytics. • Assessment: Receives a high rating. • Excellence: Indicates that the research is relevant and recognized by the international scientific community. This publication is still considered high quality and provides significant contributions to specific fields of study. • Journal Examples: PLOS ONE, Journal of Biological Chemistry, BMC Biology. 3. International Publications with Low Impact Factor or Journals Without IF Ranking: • Criteria: The dissertation manuscript is published in an international journal that does not have an impact factor or is ranked in the fourth quartile (Q4) based on Scopus or Clarivate Analytics. • Assessment: Receives a medium rating. • Excellence: Indicates that the research has reached the international scientific community, although it may not hav a significant impact. These journals still have rigorous peer review standards. • Journal Examples: Niche or regional international journals.

	4. Publications in Accredited National Journals: • Criteria: The dissertation manuscript is published in a nationally accredited journal recognized by the Directorate General of Higher Education or other journals recognized as high quality by experts in the Biology Study Program. • Assessment: Receives a medium to low rating. • Excellence: Indicates the relevance of research in the national context and is recognized by the national scientific community. This publication still demonstrates an important contribution to national scientific knowledge, even if its international impact is limited. • Journal Examples: Indonesian Journal of Biology, Journal of Science and Technology.
Study Media and Literature	4. Day, R.A., & Gastel, B. (2016). How to Write and Publish a Scientific Paper. Cambridge University Press. 5. Cargill, M., & O'Connor, P. (2013). Writing Scientific Research Articles: Strategy and Steps. Wiley-Blackwell. 6. Committee on Publication Ethics (COPE). Guidelines on Good Publication Practice.

DISSERTATION RESEARCH II

Course code	BIDB203401
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Research based learning This course is planned to have 16 weeks/semester for preparation and 2 weeks of examination.
Workload	4,25 hours/day 5 days/week 21,25 hours/week 16 Weeks/Semester total workload : 340 hours/13,6 ECTS
Credits	13.6 ECTS
Requirements	Passing the Dissertation research I.
Program Learning Outcome	CPL 3.3. Upon completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism.
Course Learning Outcome	BIDB203401.1 By the end of the Research II course, students will be able to critically evaluate and interpret data collected during the research process to identify patterns, insights, and anomalies relevant to their dissertation. BIDB203401.2 By the end of the Research II course, students will be able to Assess the validity and reliability of research methodologies and results, making informed decisions to refine or adjust approaches.

	BIDB203401.3 By the end of the Research II course, students will be able to develop comprehensive scientific arguments and innovative solutions to address complex research challenges in their field of study. BIDB203401.4 By the end of the Research II course, students will be able to Integrate findings with existing scientific literature to contribute original knowledge to the field.
Course Description	This course is a continuation of Penelitian I, focusing on the advanced stages of dissertation research. Students deepen their research activities, analyze findings, and refine their methodologies based on progress achieved in Penelitian I. The course emphasizes critical evaluation of results, advanced problem solving, and preparation for dissertation completion. Assessment is conducted through a comprehensive progress report presentation, demonstrating readiness for final research stages and contributions to scientific knowledge.
Assessments	The assessment for Dissertation Research II is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Participation (20%). B. Project (80%) • Project Result (80%)
Study Media and Literature	• Any journals related to research topic

DISSERTATION RESEARCH III

Course code	BIDB203502
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	Research based learning This course is planned to have 16 weeks/semester for preparation and 2 weeks of examination.
Workload	7,09 hours/day 5 days/week 35,47 hours/week 16 Weeks/Semester total workload : 567,5 hours/22,7 ECTS
Credits	22.7 ECTS
Requirements	Passing the Dissertation research II.
Program Learning Outcome	CPL 3.3. Upon completing this program, the graduates will be able to managing and formulating valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism. CPL 3.5. After completing this program, the graduates will be able to able to demonstrate academic leadership and increase independent learning capacity
Course Learning Outcome	BIDB203501.1 By the end of this course, students will be able to critically examine and integrate complex data to draw meaningful conclusions for their dissertation. BIDB203501.2 By the end of this course, students will be able to Assess the overall quality, validity, and impact of

	their research findings to ensure alignment with scientific standards. BIDB203501.3 By the end of this course, students will be able to develop a comprehensive dissertation document that contributes original knowledge to their field. BIDB203501.4 By the end of this course, students will be able to combine insights from research findings with existing literature to propose new theories, solutions, or advancements.
Course Description	This course serves as the final phase of dissertation research, building on the progress made in Penelitian I and Penelitian II. Students focus on completing their research, conducting advanced data analysis, and finalizing their findings. Emphasis is placed on synthesizing results, writing the dissertation, and preparing for the defense. The course ensures that students achieve a high standard of scientific rigor and make a significant contribution to their field of study.
Assessments	The assessment for Dissertation Research III is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Participation (20%). B. Project (80%) • Project Resut (80%)
Study Media and Literature	• Any journals and books related to research topic

PUBLICATION II

Course code	BIDB203302
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during	-
Workload	10,625 hours/day 5 days/week 53,125 hours/week 16 Weeks/Semester
Credits	34 ECTS
Requirements	Passing Publication I and Scientific Conference

Program Learning Outcome	CPL 1.1. contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 1.2.Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 3.2. contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology CPL 3.4. communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community CPL 3.5. After completing this program, the graduates will be able to demonstrate academic leadership and increase independent learning capacity; CPL 4.1. deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach. CPL 4.2. propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.

Course Learning Outcome	BIDB203501.1 By the end of this course, students will be able to demonstrate an understanding of the fundamental principles of effective scientific writing appropriate for reputable international journals. BIDB203501.2 By the end of this course, students will be able to Develop high-quality scientific manuscripts based on research findings that meet the standards for submission to reputable international journals. BIDB203501.3 By the end of this course, students will be able to formulate and implement writing and publication strategies in alignment with the standards and expectations of the international scientific community BIDB203501.4 By the end of this course, students will be able to communicate effectively with editors and reviewers from diverse cultural and academic backgrounds.
Course Description	This course is designed to prepare doctoral students for writing and publishing scholarly articles in reputable international journals. It covers key aspects of scientific writing strategies, appropriate journal selection, the submission and peer-review process, publication ethics, and the management of copyright and licensing. Students will be trained to develop effective writing skills and to respond to reviewers' feedback with the goal of increasing the likelihood of manuscript acceptance for publication.
Assessments	PUBLICATION CRITERIA FOR DOCTORAL PROGRAM Doctoral students are required to publish part or all of their dissertation manuscripts in recognized scientific journals. This publication is a graduation requirement and will be assessed based on the quality and reputation of the journal where the publication is made. Below are the detailed assessment criteria for publications: 1. International Publications with High Impact Factor: • Criteria: The dissertation manuscript is published in an international journal with a high impact factor (IF ≥ 5) and ranked in the first quartile (Q1) based on Scopus or Clarivate Analytics (Journal Citation Reports). • Assessment: Receives the highest rating.

- Excellence: Publication in these journals indicates that the research has significant impact and is widely recognized by the international scientific community. It reflects high research quality and significant contributions to scientific advancement.
- Journal Examples: Nature, Science, Cell, The Lancet.

2. International Publications with Medium Impact Factor:

- Criteria: The dissertation manuscript is published in an international journal with a moderate impact factor (3 ≤ IF <5) that is ranked in the second quartile (Q2) or third quartile (Q3) based on Scopus or Clarivate Analytics.
- Assessment: Receives a high rating.
- Excellence: Indicates that the research is relevant and recognized by the international scientific community. This publication is still considered high quality and provides significant contributions to specific fields of study.
- Journal Examples: PLOS ONE, Journal of Biological Chemistry, BMC Biology.

3. International Publications with Low Impact Factor or Journals Without IF Ranking:

- Criteria: The dissertation manuscript is published in an international journal that does not have an impact factor or is ranked in the fourth quartile (Q4) based on Scopus or Clarivate Analytics.
- Assessment: Receives a medium rating.
- Excellence: Indicates that the research has reached the international scientific community, although it may not hav a significant impact. These journals still have rigorous peer review standards.
- Journal Examples: Niche or regional international journals.

4. Publications in Accredited National Journals:

- Criteria: The dissertation manuscript is published in a nationally accredited journal recognized by the Directorate General of Higher Education or other journals recognized as high quality by experts in the Biology Study Program.
- Assessment: Receives a medium to low rating.
- Excellence: Indicates the relevance of research in the national context and is recognized by the national scientific community. This publication still demonstrates an important contribution to national scientific knowledge, even if its international impact is limited.
- Journal Examples: Indonesian Journal of Biology, Journal of Science and Technology.

	Evaluation Process and Graduation Honors Determination: At the latest, one month before the graduation date, a Judicium Meeting is held, attended by the Supervisory Team, Doctoral Program Coordinator, and Graduate Program Management. In this meeting, the quality of publications will be evaluated based on the above criteria to determine the graduation honors of the doctoral student: 1. **A**: Publication in high-impact international journals (IF ≥ 5) or multiple publications in international journals with medium impact factor (3 ≤ IF < 5). Publication in international journals with medium impact factor (3 ≤ IF <5) or consistently in Q3/Q4 journals. 2. **A-**: Publication in highly accredited national journals or a combination of publications in national and international journals with low impact factor. 3. **B**: Publication in low accredited national journals or a combination of publications in national and international journals with very low impact factor. With these criteria, it is expected that doctoral program students will be motivated to produce high-quality research that can make significant contributions to both international and national scientific communities.
Study Media and Literature	1. Day, R.A., & Gastel, B. (2016). How to Write and Publish a a. Scientific Paper. Cambridge University Press. 2. Cargill, M., & O'Connor, P. (2013). Writing Scientific a. Research Articles: Strategy and Steps. Wiley Blackwell. 3. Committee on Publication Ethics (COPE). Guidelines on Good Publication Practice.

DISSERTATION FINAL EXAM

Course code	BIDB203602
Course level	Doctoral Program (By Research)
Semester/ term	Odd/even
Course coordinator	Study Program Head
Lecture(s)	Doctoral candidate's Promoter Doctoral candidate's co-Promoter Examiners
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 weeks of preparation and 2 weeks of examination.
Workload	10,625 hours/day 5 days/week 53,125 hours/week 16 Weeks/Semester total workload : 850 hours/34 ECTS
Credits	34 ECTS
Requirements	Passing the Dissertation Research III.
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila. CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner; CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology

	CPL 3.4. After completing this program, the graduates will be able to communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community CPL 3.5. After completing this program, the graduates will be able to able to demonstrate academic leadership and increase independent learning capacity CPL 4.1. After participating in this program, graduates will be able to deepen and expand knowledge in the field of biology to produce models or methods or develop theories that are original, tested and innovative through research with an interdisciplinary, multidisciplinary or transdisciplinary approach CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB203602.1 By the end of this course, students will be able to critically evaluate the strengths and weaknesses of their research methodology, data, and findings during the defense. BIDB203602.2 By the end of this course, students will be able to assess the significance, originality, and contribution of their research to the academic field. BIDB203602.3 By the end of this course, students will be able to synthesize their dissertation into a compelling, well-structured defense presentation that highlights the research impact BIDB203602.4 By the end of this course, students will be able to articulate and justify their research decisions, methodology, and conclusions with clarity and logical reasoning. BIDB203602.5 By the end of this course, students will be able to respond effectively to critical questions and feedback, demonstrating comprehensive mastery of their subject matter.
Course Description	the final examination for doctoral students by research program, where they defend their completed dissertation before a panel of experts. This course evaluates the student's ability to present, justify,

	and critically discuss their research findings, methodology, and contribution to the field. The assessment focuses on the originality, rigor, and significance of the dissertation, marking the culmination of the doctoral journey and the attainment of academic excellence.The dissertation appropriateness also included in this course.
Assessments	The assessment for Dissertation (Final Exam) is based on two main components, with the respective criteria and weights: A. Dissertation Quality (50%) • Content: Background, research problems, and objectives (20%). • Research Methods: Appropriateness and rigor of the research methodology (15%). • Research Structure: Organization and systematic approach of the dissertation (10%). • Language and Writing Style: Clarity, grammar, and adherence to academic standards (5%). B. Performance During the Examination (50%) • Mastery of Content: Depth of understanding and ability to explain the research (25%). • Command of Research Methods and Reasoning: Ability to justify methodologies, logical reasoning, and coherence in formulating arguments and conclusions (25%).
Study Media and Literature	• Dissertation writing guidebook • Any journals dan books related to dissertation topic

MODULE HANDBOOK
DISSERTATION
SUPPORTING COURSES

FACULTY OF BIOLOGY
UNIVERSITAS GADJAH MADA

Population Genetics and Conservation

Course code	BIDB203001
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dra. Tuty Arisuryanti, M.Sc., Ph.D
Lecture(s)	Prof. Dra. Tuty Arisuryanti, M.Sc., Ph.D. Prof. Dr. Budi Setiadi Daryono, M.Agr Sc. Dr. Dwi Sendi Priyono, M.Si. Mukhlish Jamal Musa Holle M.Env.Sc, D.Phil.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology. CPL 3.1. After attending this program, graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology

Course Learning Outcome	BIDB203001.1 By the end of this course, Students will be able to explain the principles and assumptions of the Hardy-Weinberg Law; allele frequency and genotype frequency and their relationship; microevolution and its impacts; mechanisms of isolation and speciation; applications of population genetics for the conservation of genetic resources; species survival and population estimation size and their relationship to conservation. BIDB203001.2 By the end of this course, Students will be able to use and apply bioinformatics for the analysis of genetic variation and the mapping of population structure BIDB203001.3 By the end of this course, Students will be able to integrate data from review articles and present them effectively.
Course Description	This course explains the principles and assumptions of the Hardy-Weinberg equilibrium; allele and genotype frequencies and their interrelationship; microevolution and its impacts; mechanisms of isolation and speciation; applications of population genetics for the conservation of genetic resources; species survival and population size estimation and their relevance to conservation; and the use of bioinformatics for analyzing genetic variation and mapping population structure. Students are expected to review scientific articles, present their findings, and engage in discussions with the lecturer.
Assessments	The assessment for Selected Topic for Dissertations (Population Genetics and Conservation) is based on four components, with the respective criteria and weights: A. Mid-term Exam (20%) B. Final-term Exam (20%) C. Structured Assignment and Project (40%) D. Presentation (20%)
Study Media and Literature	1. Allendorf and Luikart. 2012.Conservation and The Genetic Populations. 2nd Edition. Blackwell Publishing (UK) 2. Campbell, N.A., L.G. Mitchell, and J.B. Reece. 2017. Biology. Concept and Connection. 9th Edition. The Benyamin Cummings Publ.Co.Inc., California (USA) 3. Gillespie, J.H. 2004. Population Genetics. A Concise Guide. 2nd Edition.The Johns Hopkins University Press, London

4. Griffith, A.J.F., J.F.Miller, D.T. Suzuki, R.C. Lewontin, and W.M. Gelbart. 2015. An Introduction to Genetic Analysis. 11th Edition. W.H. Freeman & Co., New York (USA)
5. Fox, C.W. 2006. Evolutionary Genetics: concept and case studies. Oxford University Press
6. Solomon, E.P., L.R. Berg, D.W. Martin. 2014. Biology. 10th.ed Thomson Brooks, Australia
7. Templeton, R. 2006. Population Genetics and Microevolutionary Theory. A John –Wiley and Sons, Inc., Publ., New Jersey (USA)
8. Weiss, K.M. and A.V. Buchanan. 2004. Genetics and The Logic of Evolution. Wiley-Liss. A John Wiley and Sons, Inc. Publ., New Jersey
9. Säll, T. and Bengtsson, B.O. 2017. Understanding Population Genetics . Wiley-Blackwell Publisher
10. Aristya, G.R., Handayani, N.S.N., Daryono, B.S., Arisuryanti, T.A. 2015. Karakterisasi Kromosomom Tumbuhan dan Hewan. Gadjah Mada University Press (Yogyakarta, Indonesia).
11. Daryono, B.S., Perdamaian, A.B.I. 2019. Karakterisasi dan Keragaman Genetik Ayam Lokal Indonesia. Gadjah Mada University Press (Yogyakarta, Indonesia)
12. Daryono, B.S., Martanto, S.D. 2017. Keanekaragaman dan Potensi Sumber Daya Genetik Melon. Gadjah Mada University Press (Yogyakarta, Indonesia)
13. Daryono, B.S., Tammu, R.M.. 2022. Karakteristik Potensi Genetik dan Pemanfaatan Cabai Katokkon Asal Toraja Indonesia. Gadjah Mada University Press

Plant and Animal Breeding

Course code	BIDB203002
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Budi Setiadi Daryono, M.Agr.Sc.
Lecture(s)	Prof. Dr. Budi Setiadi Daryono, M.Agr.Sc. Prof. Tety Hartatik, S.Pt., Ph.D. Dr. Aprilia Sufi Subiastuti, S.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB243023.1 By the end of this course, students will be able to demonstrate comprehensive understanding of biochemical signal transduction pathways including receptors, signaling cascades, and cellular responses as a basis for explaining molecular

	mechanisms of organismal adaptation to biotic and abiotic environmental factors. BIDB243023.2 By the end of this course, Students will be able to integrate fundamental knowledge of biochemical signaling pathways to support the development and advancement of the life sciences. BIDB243023.3 By the end of this course, Students will be able to understand and critically interpret scientific data from journal articles related to biochemical signaling mechanisms underlying adaptation in animals, plants, and microorganisms. BIDB243023.4 By the end of this course, students will be able to use a range of scientific literature to analyze and evaluate issues related to biochemical signaling pathways as mechanisms of adaptation in living organisms. BIDB243023.5. By the end of this course, students will be able to communicate scientific work related to biochemical signaling pathways as mechanisms of organismal adaptation effectively, both in written and oral formats, supported by visual presentations
Course Description	This course aims to explore cellular communication involving signal perception by cellular receptors, signal transduction, and cellular responses that enable organisms (animals, plants, and microorganisms) to adapt to environmental changes. Natural phenomena related to the ability of living organisms to adapt to both biotic and abiotic environments are studied through a molecular approach. The course includes an understanding of fundamental strategies, capacities, and mechanisms of adaptation, with emphasis on the diversity of adaptive patterns and processes mediated by complex biomolecular networks.
Assessments	The assessment for Selected Topic for Dissertations (Biochemical Signaling Systems) is based on three main components, with the respective criteria and weights: A. Participatory Activity (10%) • Participation (10%) B. Project (40%) • Presentation (25%) • Article (10%) C. Kognitif (50%) • Stuctured Assignment/Task (5%) • Quizz (5%) • Mid-term Exam (20%) • Final-term Exam (20%)

Study Media and Literature	**Main** 1. Berg,J.M., Tymochka, J.L. and L.Stryer, 7th, pdf, W.H. Freeman & Co. 2. Buchanan,B.B.; Gruissem,W. and R.l. Jones, (2001), Biochemistry and Molecular Biology of Plants, 3rd ed. , American Society of Plant Physiologist, Maryland USA 3. Edwards, C ed. (1990), Microbiology of Extreme Environment, Open university Press, Milton Keynes 4. Hochachka, P. and G.N. Somero (1984), Biochemical Adaptation,W.B.Saunders, Princeton University Press, Princeton 5. Hochachka, P. and G.N. Somero (2002), Biochemical adaptation: Mechanism and process physiological evolution. Oxford University Press. 6. Lehninger,A.L.;Nelson, D.l. & M.M.Cox, (2018) Principles of Biochemistry, 4th ed., (pdf) **Additional** 1. Anik Hidayah, Rizka Rohmatin Nisak, Febri Adi Susanto, Tri Rini Nuringtyas, Nobutoshi Yamaguchi, Yekti Asih Purwestri. 2022. Seed Halopriming Improves Salinity Tolerance of Some Rice Cultivars During Seedling Stage. Botanical Studies 63:24 https://doi.org/10.1186/s40529-022-00354-9 2. Alfino Sebastian, Ilham Cahyo Nugroho, Herdin Surya Dwi Putra, Febri Adi Susanto, Putri Wijayanti, Nobutoshi Yamaguchi, Tri Rini Nuringtyas, Yekti Asih Purwestri. 2022. Identification and characterization of drought-tolerant local pigmented rice from Indonesia. Physiol Mol Biol Plants 28(5):1061–1075 https://doi.org/10.1007/s12298022-01185-5

Medical Histology

Course code	BIDB203008
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr.med.vet. drh. Hendry Saragih, M.P.
Lecture(s)	Dr.med.vet. drh. Hendry Saragih, M.P. Prof.Dr. Bambang Retnoaji, S.Si., M.Sc. Zuliyati Rohmah, S.Si., M.Si., Ph.D.Eng. Dr. Ardaning Nuriliani, S.Si., M.Kes.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology. CPL 2.2. After attending this program, graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology CPL 3.2. After completing this program, the graduates demonstrate an undertanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development
Course Learning Outcome	BIDB203008.1 By the end of this course, Students will be able to understand the basic concepts, principles, and theories related to the structure of normal and damaged cells and tissues.

	BIDB203008.2 By the end of this course, Students will be able to understand conventional and modern histological methods in the analysis of cell/tissue damage, abnormalities, and disorders. BIDB203008.3 By the end of this course, students will be able to understand the approaches to identifying, characterizing, and analyzing damage, abnormalities, and disorders in cells and tissues. BIDB203008.4 By the end of this course, students will be able to apply the acquired knowledge in research fields, including biomedical sciences.
Course Description	This course explores the cellular architecture of tissues and provides an in-depth understanding of body function, particularly in relation to disease. The course integrates both conventional and modern histological approaches to facilitate learning. Students will gain knowledge of the structural differences between healthy and diseased cells and tissues. This course also equips students with the foundational skills necessary to analyze cellular and tissue damage, which can be applied in research focused on structural changes caused by internal and external factors
Assessments	The assessment for Selected Topic for Dissertations (Medical Histology) is based on three main components, with the respective criteria and weights: E. Partisipatory Activity (20% F. Project Result/Case Studi result/PBL Result (30%) G. Kognitif • Assignment (5%) • Quizz (5%) • Mid-term Exam (20%) • Final-term Exam (20%)
Study Media and Literature	**Main**: 1. Kumar, Abbas, & Aster. 2015. Robbins and Cotran Pathologic Basis of Disease. 9th edition. 2. Sattar, H.A. 2020. Fundamentals of Pathology. Medical Course and Step 1 Review. Pathoma. 1st. Ed. 3. Junqueira, L.C. and J. Carneiro. 2018. Basic Histology: Text and Atlas. 15th edition. McGraw-Hill Companies, Inc. 4. Kierzenbaum. A. L. 2002. Histology and Cell Biology. An Introduction to Pathology. St. Louis: Mosby Inc. 5. Pawlina, W. 2016. Histology: A Text and Atlas with Correlated Cell and Molecular Biology. 7th edition. Wolters Kluwer **Addition:**

	1. Eroschenko V.P. 2003. Atlas Histologi di Fiore dengan Korelasi Fungsional (Terj.). Edisi 9. Penerbit Buku Kedokteran EGC. Jakarta. 2. Stevens, A. and J. Lowe. 2004. Human Histology. 2nd Edition. Mosby. UK. 3. Lutz Slomianka, 2009, Blue Histology, University of Western Australia, http://www.lab.anhb.uwa.edu.au/mb140/ 4. https://histology.medicine.umich.edu/resources 5. http://stevegallik.org/histologyolm_toc.html 6. https://www.histology.leeds.ac.uk/

Capita Selecta I

Course code	BIDB203103
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng.
Lecture(s)	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng. Prof. Dr. Budi S. Daryono, M.Agr.Sc.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 2.1. Upon completing this program, the graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment

Course Learning Outcome	BIDB203103.1 By the end of this course, students will gain knowledge and understanding of the probiotic characteristics of lactic acid bacteria isolated from wild fruits in Indonesia. BIDB203103.2 By the end of this course, students will be able to analyze analyze the potential of lactic acid bacteria isolated from wild fruits in Indonesia as fermentation starters. BIDB203103.3 By the end of this course, students will be able to manage, lead, and develop research on the fermentation activity of selected lactic acid bacteria. BIDB203103.4 By the end of this course, students will be able to solve problems related to the standardization of lactic acid bacteria as fermentation starters for coffee
Course Description	This course explores the probiotic characteristics of lactic acid bacteria isolated from wild fruits in Indonesia and their potential as fermentation starters for coffee. It also examines the fermentation activity of lactic acid bacteria and the quality of fermented coffee products.
Assessments	The assessment for Selected Topic for Dissertations (Kapita Selekta) is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Stuctured Assigment/Task (10%) • Participation (10%) B. Project (80%) • Mid-Term Exam (30%) • Final-Term Exam (30%) • Project Result/Case Study/Project Based Learning result (20%)
Study Media and Literature	**Main** 1. Vinderola, G., Ouwehand, A., Salminen, S., Von Wright, A.2019. Lactic Acid Bacteria, Microbiological and Functional Aspects. 5th Edition. CRC Press. **Additional** 1. Wahidin, S. 2010. Lactic acid fermentation by immobilized bacteria identification of important factors that influence the performance of lactic acid production. VDM Verlag Dr. Müller

Capita Selecta II

Course code	BIDB203103
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Endang Semiarti, M.S., M.Sc.
Lecture(s)	Dr. Eko Agus Suyono,M.App.Sc Prof. Dr. Endang Semiarti, M.S., M.Sc. Dr. Miftahul Ilmi, S.Si., M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 1.3. Upon completing this program, the graduates demonstrate an attitude of being able to internalize academic values, norms and ethics. CPL 3.4. After completing this program, the graduates will be able to communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community

	CPL 3.5. After completing this program, the graduates will be able to demonstrate academic leadership and increase independent learning capacity
Course Learning Outcome	BIDB203103.1 By the end of this course, students will be able to discover or develop new theories, concepts, or scientific ideas in the field of animal and plant biotechnology, involving both unicellular and multicellular organisms BIDB203103.2 By the end of this course, students will be able to to contribute to the advancement and application of biology through scientific research based on scientific principles and ethics, by employing interdisciplinary, multidisciplinary, or transdisciplinary approaches to address problems in animal and plant biotechnology involving both unicellular and multicellular organisms. BIDB203103.3 By the end of this course, students will be able to manage and formulate valid research data in the field of animal and plant biotechnology (both unicellular and multicellular), in a responsible manner by upholding academic integrity and promoting anti-plagiarism principles.
Course Description	This course covers special dissertation-related topics in the field of in vitro culture and plant biotechnology. It provides an overview of improving the quality of individuals/organisms through biotechnology, including in vitro culture and genetic engineering.
Assessments	The assessment for Selected Topic for Dissertations (Kapita Selekta) is based on three components, with the respective criteria and weights: • Stuctured Assigment/Task (30%) • Final-Term Exam (40%) • Presentation (30%)
Study Media and Literature	**Main** 1. Semiarti, E., Indrianto, A.,Purwantoro, A., Machida, Y, and Machida C. (2011) Agrobacterium-Mediated Transformation of Indonesian Orchids for Micropropagation, Chapter 11th in: Scientific e-book Genetic Transformation ISBN 978-953-307-364-4, ed by M.Alvarez, InTech-Open Publisher, DOI: http://dx.doi.org/10.5772/intechopen.103839 2. Semiarti, E., Y.A. Purwestri, S. Rohman, and W.A. Putri (2022). Genetic Transformation in Prokaryotic and Eukaryotic Cells.

Chapter 2 in “Molecular Cloning”, p 27-46, ed.by Sadik Dincer, IntechOpen Publisher, Print ISBN 978-1-80355-450-1, ISBN 978-1-80355-451-1, DOI: http://dx.doi.org/10.5772/intechopen.103839

3. Semiarti, E., Y.A. Purwestri, S. Rohman, and W.A. Putri (2023). Bioteknologi Tanaman, Gadjah Mada University Press, 1-178 halaman. ISBN: 978-623-359-167-6.
4. Andersen, R.A. 2005. Algal Culturing Technique. Elsevier Academic Press. UK.
5. Suyono, et al. 2024.The Effect of Various Photoperiodic Conditions and Zn2+ Concentrations on Growth Rate and Metabolite Content in Euglena sp. Journal of Tropical Life Science, Vol. 14, No. 2, 237 – 252 http://dx.doi.org/10.11594/jtls.14.02.04
6. Suyono, et al. 2024. Metabolite Compounds of Euglena sp. on Mass Cultivation System under MgCl2 and CaCl2 Salt Stress. International Journal on Advanced Science, Engineering and Information Technology, vol. 14, no. 3, pp. 1057-63, doi:10.18517/ijaseit.14.3.19820.

Additional

1. 1. Semiarti,E., S.Nopitasari, Y. Setiawati, M.D. Lawrie, A. Purwantoro, J. Widada, K. Ninomiya, Y. Asano, S. Matsumoto, Y.Yoshioka (2020). Application of CRISPR/Cas9 genome editing system for molecular breeding of orchids. Indones J Biotechnol 25(1), 2020, 61?68 | DOI 10.22146/ijbiotech.39485, www.jurnal.ugm.ac.id/ijbiotech
2. Semiarti E., Indrianto A., Purwantoro A., Martiwi I. N. A., Feroniasanti Y. M. L., Nadifah F., Mercuriana I. S., Dwiyani R., Iwakawa H., Yoshioka Y., Machida Y. and Machida C. (2010). High-frequency genetic transformation of Phalaenopsis amabilis orchid using tomato extract-enriched medium for the pre-culture of protocorms. The Journal of Horticultural Science and Biotechnology, Vol. 85 No. 3: 205-210 (2010)
3. Semiarti, E., Indrianto A, Purwantoro A., Isminingsih S., Suseno N., Ishikawa T., Yoshioka Y., Machida Y., and Machida C. 2007. Agrobacterium-mediated transformation of the wild orchid species Phalaenopsis amabilis. Plant Biotechnology.Vol. 24. No.3

Capita Selecta III

Course code	BIDB203103
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Kumala Dewi, M.Sc.St.
Lecture(s)	Prof. Dr. Kumala Dewi, M.Sc.St. Prof. Dr. Endah Retnaningrum, S.Si., M.Eng. Prof. Dr. rer. nat. Andhika Puspito Nugroho, S.Si., M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 1.2.Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.

Course Learning Outcome	BIDB203103.1 By the end of this course, students will explain various factors influencing plant growth and secondary metabolite synthesis. They demonstrate an understanding of plant adaptation and interactions with the environment, including factors related to global climate change BIDB203103.2 By the end of this course, students will be able to explain the regulation and interaction of glucosinolate biosynthetic pathways, as well as understand the mechanisms of mycorrhizal infection and the application and analysis of mycorrhizal colonization in plant roots. BIDB203103.3 By the end of this course, students will be able to to compose a dissertation research proposal
Course Description	This course provide fundamental knowledge on various factors influencing plant growth and secondary metabolite synthesis, understanding of plant adaptation and interaction with the environment and global climate change factors. understanding of the regulation and interaction of glucosinolate biosynthetic pathways; and knowledge of mycorrhizal infection mechanisms, including their application and analysis in plant roots.
Assessments	The assessment for Selected Topic for Dissertations is based on three main components, with the respective criteria and weights: A. Participatory Activity (5%) • Participation (5%) B. Project (5%) • Project Result/Case Study/Project Based Learning result (5%) C. Kognitif/Knowledge (90%) • Structured Assignment/Task (5%) • Quizz (5%) • Mid-term Exam (40%) • Final-term Exam (40%)
Study Media and Literature	• Bhatla, S.C.· Manju, A.L. 2018. Plant Physiology, Development and Metabolism. Springer. • Suarez, M.F. dan P.V. Bozkhov. 2008. Plant Embryogenesis. Springer. • Taylor et al. 2017. Essentials of Developmental Plant Anatomy. Oxford University Pres. • Chen, X and T. Laux. 2012. Growth and Development. (Eds) Current Opinion in Plant Biology 15(1): 1-110.

Capita Selecta IV

Course code	BIDB203103
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr. Rury Eprilurahman, S.Si., M.Sc.
Lecture(s)	Dr. Rury Eprilurahman, S.Si., M.Sc. Dr. Dra. Rr. Upiek Ngesti Wibawaning Astuti, B.Sc., DAP&E. M.Biomed. Dr. Dwi Sendi Priyono, S.Si, M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila; CPL 2.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development;

	CPL 3.1. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology
Course Learning Outcome	BIDB203103.1 By the end of this course, students will be able to demonstrate advanced knowledge and critical understanding of the fundamental principles of Selected Topics in Animal Systematics. BIDB203103.2 By the end of this course, students will be able to develop knowledge and technology in the field of Animal Systematics, particularly in relation to their Dissertation research. BIDB203103.3 By the end of this course, students will be able to manage, lead, and develop research in the field of Animal Systematics. BIDB203103.4 By the end of this course, students will be able to solve problems in the field of Animal Systematics through inter- and multidisciplinary approaches.
Course Description	This course comprises specialized topics in Animal Systematics that are directly related to dissertation research. The content is tailored to the expertise of the supervisory team and aligned with the taxon or topic selected for dissertation study. In general, the course is highly dynamic, adjusted to the specific needs of the students, and closely connected to the academic specializations of the supervisory team.
Assessments	The assessment for Selected Topic for Dissertation (Capita Selecta) is based on four components, with the respective criteria and weights: A. Mid-term Exam (25%) B. Final-term Exam (25%) C. Project 1 (25%) D. Project 2(25%)
Study Media and Literature	**Main:** 1. Ackers, R. et al., 2007. Sponges of the British Isles (Sponge V): a colour guide and working documents. 2. Beesley, P.L., Ross, G.J.B. & Wells, A. (eds) (1998). Mollusca: The Southern Synthesis. A Fauna of Australia. Vol.5. CSIRO Publishing: Melbourne, Part A. 3. Cogger, H.G. and R.G Zweifel. 2003. Encyclopedia of Reptiles and Amphibians. Frog City Press. San fransisco. Pp: 240. 4. Dance, Peter S., 1992. Shells. Dorling Kindersley, London.

5. Dorit, Robert L. Warren F walker, Jr., Robert D Barnes. 1991. Zoology. Saunders College Publishing. USA. Pp: 236 – 253.
6. Hooper, J.N.A., van Soest, R.W.M. (eds.) 2002. Systema Porifera: A Guide to the Classification of Sponges. Kluwer Academic/Plenum Publishers, New York.
7. Iskandar, D.T., 1998. Amfibi Jawa dan Bali: Seri Panduan Lapangan. Cetakan pertama, Puslitbang Biologi-LIPI, Bogor. Hal: 1 – 7.
8. Jeffrey, C .1973. Biological Nomenclature. 3rd ed. Edward Arnold, London.
9. Kottelat, M., A.J. Whitten, S.N. Kartikasari and S. Wirjoatmodjo. 1993. Fresh Water Fishes of Western Indonesia and Sulawesi. Periplus Editions Limited, Jakarta.
10. Lagler, K.F, J.E. Bardach, R.R. Miller, and D.R.M. Passino. 1977. Ichthyology, 2nd Edition. John Wiley and Sons Company. Toronto, Canada.
11. Mayr, E. & P.D. Ash. 1991. Principles of Systematic Zoology. Mc Graw Hill, Inc. pp.475.
12. Nelson, Joseph S., 2006. Fishes of The World. 4th ed. John Wiley & Sons, Inc. New Jersey.
13. Orr, R.T. 1976. Vertebrate Biology. 4th ed. W.B. Saunders Company. Philadelphia, USA.
14. Pechenik, J.A. 2000. Biology of the Invertebrates. McGraw-Hill Higher Education. Singapore..

additional:

1. Any journals related to dissertation topic

Plant Ecophysiology

Course code	BIDB203107
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Diah Rachmawati, S.Si., M.Si.
Lecture(s)	Prof. Dr. Diah Rachmawati, S.Si., M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203107.1 By the end of this course, students will be able to evaluate the role of abiotic and biotic environmental factors in plant metabolism, growth, and development, as well as the physiological, biochemical, and molecular response mechanisms of plants to global climate change.

	BIDB203107.2 By the end of this course, students will be able to integrate and analyze problems related to plant ecophysiology and strategies to address them from various sources.
Course Description	This course explores the role of environmental factors as resources for plants, plant interactions with abiotic and biotic environmental factors, and environmental signaling affecting plant metabolism, growth, and development. It also examines the physiological, biochemical, and molecular response mechanisms of plants to environmental changes. Case studies address the effects of dynamic abiotic and biotic environmental factors on plant metabolism, growth, and development, as well as strategies to mitigate the impacts of global climate change.
Assessments	The assessment for Selected Topic for Dissertations (Plant Ecophysiology) is based on two main Component, with the respective criteria and weights: A. Participatory activity (20%) • Participation (20%) B. Project(80%) • Project Result/Case Study/Project Based Learning result (80%)
Study Media and Literature	1. 1. Lambers, H., F.S. Chapin III, T.L. Pons. 2008. Plant Physiological Ecology. Springer-Verlag New York, Inc. 2. Pareek, A., Sopory, S.K., Bohnert, H.J. and Govindjee. 2010. Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation. Springer. The Netherlands. 3. Pessarakli, M. 2014. Handbook of Plant and Crop Physiology. 3rd Edition. CRC Press. Taylor & Francis Group. Boca Raton London New York 4. Taiz, L. and E. Zieger. 2015. Plant Physiology 5 Ed. Sinauer Associates, Inc., Publisher. Sunderland, Massachusetts.

Natural Product Metabolism

Course code	BIDB203108
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. L. Hartanto Nugroho M.Agr.
Lecture(s)	Prof. Dr. L. Hartanto Nugroho M.Agr. Dr. Tri Rini Nuringtyas M.Sc.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology CPL 4.3 After participating in this program, graduates will be able to apply the philosophy of biological systems in developing

	biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB203108.1 By the end of this course, students will be able to accurately apply the concepts and principles of natural product metabolism to elucidate the biosynthetic pathways of various secondary metabolites, analyze the characteristics of each metabolite group, and evaluate the benefits of secondary metabolites for the producing organisms and for humans, through doctoral-level research. BIDB203108.2 By the end of this course, students will be able to determine appropriate data types and data collection methods in accordance with the objectives of their dissertation research within the scope of natural product metabolism. BIDB203108.3 By the end of this course, students will be able to demonstrate the ability to develop, modify, and innovate research methodologies to effectively achieve dissertation research objectives in the field of natural product metabolism BIDB203108.4 By the end of this course, students will be able to demonstrate the ability to select and apply appropriate data analysis methods and interpret the results to address research problems and achieve the objectives of dissertation research in the field of natural product metabolism, including proficiency in using software tools for secondary metabolite profiling.
Course Description	This course explores the metabolism of natural products with a focus on secondary metabolites. Topics include the classification of secondary metabolites based on their molecular structures and metabolic pathways, as well as the structural characteristics of these compounds within plant systems. The course also examines the specific plant tissues or cells where secondary metabolites are accumulated and introduces a range of methods used for the separation and analysis of secondary metabolites. Through this course, students will gain a comprehensive understanding of the biochemical diversity and analytical approaches relevant to natural product metabolism.

Assessments	The assessment for Selected Topic for Dissertations (Natural Product Metabolism) is based on four components, with the respective criteria and weights: 1. Stuctured Assigment/Task (20%) 2. Presentation (20%) 3. Mid-Term Exam (30%) 4. Final-Term Exam (30%)
Study Media and Literature	**Main** 1. Dewick, P.M. 2009. Midicinal natural product: A biosyntesis approach. John Wiley and Sons Ltd. Chichester. 2. Nugroho, L. H. 2017. Strukur dan produk jaringan sekretori tumbuhan. Universitas Gadjah Mada Press. Indoenesia 3. Harborne, J.B. 1982. Introduction to ecological biochemistry. Academic Press, Inc. London. 4. Samuelsson, G. 1999. Drug of Natural Origin. Swedish Pharmaceutical Society. Swedish Pharmaceutical Press. Sweden. **Additional** 1. Nugroho, L. H. dan Hartini, YS. 2020. Farmakognosi Tumbuhan Obat: Kajian Spesifik Genus Piper. Universitas Gadjah Mada Press. Indonesia 2. Nugroho, L. H. dan Hartini, YS. 2024. Tumbuhan Obat Antidiabetik: Etnomedisin, Ramuan, dan Mekanisme Aksi. Universitas Gadjah Mada Press. Indonesia.

Algae Engineering

Course code	BIDB203137
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr. Eko Agus Suyono,M.App.Sc
Lecture(s)	Dr. Eko Agus Suyono,M.App.Sc
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 1.3. Upon completing this program, the graduates demonstrate an attitude of being able to internalize academic values, norms and ethics. CPL 3.4. After completing this program, the graduates will be able to communicate research results through reputable media and scientific publications to the academic community and/or directly to the wider community CPL 3.5. After completing this program, the graduates will be able to demonstrate academic leadership and increase independent learning capacity

Course Learning Outcome	BIDB203137.1 By the end of this course, students will be able to discover or develop new theories, concepts, or scientific ideas in the field of algae engineering BIDB203137.2 By the end of this course, students are able to contribute to the development and application of biology through scientific research based on scientific principles and ethics, using interdisciplinary, multidisciplinary, or transdisciplinary approaches to solve problems in the field of algae engineering. BIDB203137.3 By the end of this course, students will be able to manage and formulate valid research data in the field of algal engineering with full academic integrity and a strong commitment to anti-plagiarism.
Course Description	This course covers specialized topics related to dissertation research in the field of microalgae engineering. It includes discussions on microalgae diversity, habitats and distribution, nutrition and cultivation media, sampling and isolation techniques, laboratory-, pilot-, and mass-scale cultivation methods, harvesting and cryopreservation techniques, as well as biorefinery and bioprospecting approaches.
Assessments	The assessment for Selected Topic for Dissertations (Algae Engineering) is based on three components, with the respective criteria and weights: • Structured Assignment/Task (30%) • Mid-term Exam (30%) • Final-term Exam (30%) • Presentation (10%)
Study Media and Literature	**Main:** 1. Andersen, R.A. 2005. Algal Culturing Technique. Elsevier Academic Press. UK. 2. Suyono, et al. 2024.The Effect of Various Photoperiodic Conditions and Zn2+ Concentrations on Growth Rate and Metabolite Content in Euglena sp. Journal of Tropical Life Science, Vol. 14, No. 2, 237 – 252 http://dx.doi.org/10.11594/jtls.14.02.04 3. Suyono, et al. 2024. Metabolite Compounds of Euglena sp. on Mass Cultivation System under MgCl2 and CaCl2 Salt Stress. International Journal on Advanced Science, Engineering and Information Technology, vol. 14, no. 3, pp. 1057-63, doi:10.18517/ijaseit.14.3.19820. **Additional**

	1. Tia Erfiantia , Istini Nurafifaha , Brilian Ryan Sadewob, Budi Setiadi Daryono, Eko Agus Suyonoa, and Arief Budiman. 2024. Comparison of CO2 absorption via terrestrial plants and microalgae: A review. Asia Pacific Journal of Moleculer Biology and Biotechnology. Vol. 32 (2) : 15-26 2. Erik Lawijaya, Dwi Umi Siswanti and Eko Agus Suyono. 2023. Optimisation of Bioflocculation Using Anabaena sp. and Navicula sp. for Harvesting of Glagah Microalgae Consortium. Pertanika Journal of Tropcal Agriculture Science. 46 (4): 1083 - 1096

Plant Nutrition

Course code	BIDB203115
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Diah Rachmawati, S.Si., M.Si.
Lecture(s)	Prof. Dr. Diah Rachmawati, S.Si., M.Si. Dr. Eka Tarwaca Susila Putra., S.P., M.P.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203115.1 By the end of this course, students will be able to evaluate the roles, kinetics, dynamics, and availability of nutrients in relation to plant metabolism, growth, and development, as well as the mechanisms by which plants respond to nutrient imbalances.

	BIDB203115.2 By the end of this course, students will be able to integrate and evaluate issues related to plant nutrition and strategies for their resolution from various sources.
Course Description	This course examines the roles of essential and beneficial nutrients for plants. It covers nutrient availability, uptake, and metabolism within the plant body. The role of microbes in nutrient dynamics and availability in the soil, and their influence on plant growth, is also discussed. Nutrient status and soil fertility analysis are studied in relation to plant growth quality and resistance. Additionally, the course explores the effects of environmental stresses (drought, salinity, pH, and pollutants) on nutrient status in soil and plants, as well as plant adaptations to nutrient imbalances. Case studies focus on the relationship between nutrient availability and plant growth quality, pest and disease resistance, and the potential and prospects of organic fertilizers.
Assessments	The assessment for Selected Topic for Dissertations (Plant Nutrition) is based on two main Component, with the respective criteria and weights: C. Participatory activity (20%) • Mid-term Exam (10%) • Final-term Exam (10%) D. Project(80%) • Mid-term Exam (40%) • Final-term Exam (40%)
Study Media and Literature	1. Barker A.V. and Pilbeam D.J. 2015. Handbook of Plant Nutrition 2nd edition.CRC Press. Taylor & Francis Group. Boca Raton, London, New York. 2. Fageria, N.K., V.C. Baligar & C.A. Jones 2010. Growth and mineral nutrition of field crops. CRC Press. Taylor & Francis Group. Boca Raton, London, New York. 3. Marschner, H. 2012. Mineral nutrition of higher plants. Third Edition. Acad Press, London 4. Rengel, Z (Ed.) 1999. Mineral nutrition of crops. Fundamental mechanism and implications. Food Product Press-The Haworth Press, Inc., New York. 5. Taiz, L. and E. Zieger. 2015. Plant Physiology 5th Ed. Sinauer Associates, Inc., Publisher. Sunderland, Massachusetts

Microbial Ecology

Course code	BIDB203124
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng.
Lecture(s)	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng.
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203124.1 By the end of this course, students gain knowledge and understanding of the adaptation, development, and succession of microorganism populations within ecosystems. BIDB203124.2 By the end of this course, students will be able to analyze analyze the diversity and dynamics of microorganism populations in various ecosystems

	BIDB203124.3 By the end of this course, students will be able to manage, lead, and develop research on microorganism-organism interactions and intercellular communication among microorganisms BIDB203124.4 By the end of this course, students will be able to human life challenges through the application of microbial populations in various ecosystems
Course Description	This course covers the adaptation, development, and succession of microorganism populations within ecosystems, as well as the diversity and dynamics of these populations in various ecosystems. It also explores interactions between microorganisms and other organisms, and intercellular communication among microorganisms. Recent research on the application of microbial populations in diverse ecosystems is integrated into each topic, enabling students to analyze and solve relevant problems
Assessments	The assessment for Selected Topic for Dissertations (Microbial Ecology) is based on two main components, with the respective criteria and weights: A. Participatory Activity (40%) • Mid-Term Exam (30%) • Participation (10%) B. Project (60%) • Stuctured Assigment/Task (10%) • Final-Term Exam (30%) • Project Result/Case Study/Project Based Learning result (20%)
Study Media and Literature	**Main** 1. Barton, L. L., Diana E. Northup, D. E. 2011. Microbial Ecology. John Wiley & Sons, 2011 **Additional** 1. Tate, R. L. 2020. Soil Microbiology. John Wiley & Sons, 2. Ashok Kumar Chauhan, A. K., Varma, A. 2006. Microbes: Health and Environment. Anshan Publishers Scientific Publishers

Molecular Systematic

Course code	BIDB203125
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dra. Tuty Arisuryanti, M.Sc., Ph.D.
Lecture(s)	Prof. Dra. Tuty Arisuryanti, M.Sc., Ph.D. Sukirno, S.Si., M.Sc., Ph.D..
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203125.1 By the end of this course, students will be able to explain the development of molecular systematics, analyze controversies in molecular systematics, and discuss the applications and prospects of molecular systematics.

	BIDB203125.2 By the end of this course, students will be able to design research and molecular techniques used in molecular systematics studies, explain species identification methods using DNA barcode and metabarcode, perform intra- and interspecific differentiation analyses (using genetic distance and evolutionary models), and construct phylogenetic trees based on Neighbour Joining (NJ), Maximum Likelihood (ML), and Bayesian Inference (BI) methods.. BIDB203125.3 By the end of this course, students will be able to use and compare free software for data analysis in molecular systematics.
Course Description	This course is delivered through blended learning and covers a collaborative range of topics, including the development and controversies in molecular systematics; applications and prospects of molecular systematics; research design and molecular techniques used in molecular systematics studies; species identification using DNA barcode and metabarcode methods; intra- and interspecific differentiation (genetic distance methods and evolutionary models); phylogenetic tree construction methods; and the use of free software in molecular systematics. The primary learning objective of this course is to provide knowledge of molecular systematics and skills in using software for data analysis.
Assessments	The assessment for Selected Topic for Dissertations (Molecular Systematic) is based on Project Component, with the respective criteria and weights: 1. Stuctured Assigment/Task (50%) 2. Project Result/Case Study/Project Based Learning result (50%)
Study Media and Literature	1. DeSalle, R., Giribet, G., Wheeler, W. 2013. Molecular Systematics and Evolution: Theory and Practice. Birkhäuser Ltd. 2. Stewart, C. 2014. Comparative DNA Sequencing as a Tool of Molecular Systematics Koros Press Ltd

Endocrinology

Course code	BIDB203186
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr.biol.hom. Nastiti Wijayanti, S.Si., M.Si
Lecture(s)	Dr. Slamet Widiyanto, S.Si., M.Sc Dr.biol.hom. Nastiti Wijayanti, S.Si., M.Si Dr.med.vet. drh. Hendry TSSG Saragih, M.P
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1. Upon completing this program, the graduates demonstrate an attitude of being able to discover or develop new scientific theories/concepts/ideas in biology CPL 3.1. After attending this program, graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems
Course Learning Outcome	BIDB203186.1 Students demonstrate an understanding of the fundamental principles of physiology and endocrinology. BIDB203186.2 Students demonstrate an understanding of the mechanisms and regulatory actions of hormones relevant to their research topic. BIDB203186.3 Students demonstrate the ability to design research studies and identify appropriate parameters and methods for analysis.

Course Description	This course explores chemical signaling (hormonal signaling), which plays a critical role in all biological processes within the body. A fundamental understanding of hormone synthesis, secretion, circulation, inactivation, and elimination is essential for comprehending the regulatory mechanisms within biological systems. The course begins with the study of the hypothalamic-pituitary axis as the central regulatory mechanism of the endocrine system, followed by advanced signaling pathways in peripheral endocrine organs. These include thyroid metabolism, digestive metabolism closely related to pancreatic hormones, reproductive hormones, and other metabolic processes in living organisms, particularly in mammals. Course content will be tailored to align with each student's research plan.
Assessments	The assessment for Selected Topic for Dissertations (Endocrinology) is based on five components, with the respective criteria and weights: • Participatory Activity (10%) • Literature Review (25%) • Result Design of Research Roadmap (10%) • Mid-term Exam (30%) • Research Proposal Draft in the field of endocrynology (30%)
Study Media and Literature	**Main:** 1. Norris, D.O. 2006. Vertebrate Endocrinology. Fourth Edition. Academic Press. Waltham, Massachusetts.5 2. Richard E. Jones and Kristin H. Lopez, Human Reproductive Biology (4th Edition), Elsevier, 2014 3. Pierre J. Lefebvre, Daniel G. Pipeleers, 2012. The Pathology of The Endocrine Pancreas in diabetes **Additional** 1. Any reputable journals related to endocrynology topic

Cell and Molecular Genetics

Course code	BIDB203126
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Niken Satuti Nur Handayani, M.Sc.
Lecture(s)	Prof. Dr. Budi Setiadi Daryono, M.Agr Sc. Prof. Dr. Niken Satuti Nur Handayani, M.Sc. Prof. Dra. Tuty Arisuryanti, M.Sc., Ph.D. Ganies Riza Aristya, S.Si., M.Sc., Ph.D.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203126.1 By the end of this course, students are able to analyze and explain the cell cycle and its regulation, chromosomal structural and numerical aberrations along with their consequences; explain the

	regulation of gene expression in prokaryotic and eukaryotic organisms; and describe the mechanisms underlying genome variation and its associated aspects. BIDB203126.2 By the end of this course, students are able to conduct research in the field of biology, particularly genetics, both independently and in teams; solve various problems related to DNA analysis; and apply molecular markers and genetic engineering in the fields of genetics and the breeding of biological resources. BIDB203126.3 By the end of this course, students are able to effectively communicate their research findings in both written and oral forms
Course Description	This course covers the regulation of the cell cycle, causes and consequences of chromosomal aberrations, genome variation and genome libraries, gene expression and its regulation, DNA analysis, and the application of molecular markers in various fields. It also includes genetic engineering and its practical applications. Students are expected to review scientific articles, present their findings, and engage in discussions with the instructor.
Assessments	The assessment for Selected Topic for Dissertations (Cell and Molecular Genetics) is based on four components, with the respective criteria and weights: 1. Mid-Term Exam (30%) 2. Final-Term Exam (30%) 3. Discussion (20%) 4. Presentation (20%)
Study Media and Literature	**Main** 1. Albert, B., Bray, D., Lewis, J., Raff, M., Robert, K., Watson, J.D. Molecular Biology of the Cell. Garland Publ. Inc., New York. 2. Watson, J.D., Gilman, M., Witkowski, J., and Zoller, M. Recombinant DNA. Freeman and Co., New York. **Additional** 1. Brown, T.A. Genomes. New York and London: Garland Science 2. Griffiths, Anthony J.F.; Gilbert, William M.; Miller, Jeffrey H.; Lewontin, Richard C. Modern Genetic Analysis. New York: W. H. Freeman & Co. 3. Klug, W.S. and R. Cummings. Concept of Genetics. Prentice Hall Inc., New Jersey (USA)

4. Reece, R.J. Analysis of Genes and Genomes. John Wiley & Sons, Inc., New York.

Plant Hormone Biosynthesis

Course code	BIDB203161
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Kumala Dewi, M.Sc.St
Lecture(s)	Prof. Dr. Kumala Dewi, M.Sc.St
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	Receiving approval from the Supervisory Team.
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila. CPL 1.3. Upon completing this program, the graduates demonstrate an attitude of being able to internalize academic values, norms and ethic CPL 2.3. After attending this program, graduates demonstrate an understanding of new concepts in the fields of biology and applied biology CPL 4.3 After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment
Course Learning Outcome	BIDB203161.1 By the end of this course, students will understand the fundamental aspects of classical and novel phytohormones, plant growth regulators, and their applications in agriculture. They will be able to explain the physiological functions and mechanisms

	of various plant hormones and analyze their individual and interactive effects on plant growth BIDB203161.2 By the end of this course, students will understand of regulatory mechanisms gained by students will be useful in achieving or promoting optimal plant growth under various conditions, including normal and stress environments, as well as enhancing productivity—especially in cultivated plants valuable for food, feed, natural dyes, health, and other uses. BIDB203161.3 By the end of this course, students will be able to prepare a dissertation research proposal
Course Description	This course provides fundamental knowledge on various aspects of phytohormones, including classical and newly discovered phytohormones, plant growth regulators, and their applications in agriculture. It covers the physiological functions and mechanisms of different plant hormones, as well as their effects on plant growth, both individually and through hormone interactions. Students will also learn quantitative methods for phytohormone analysis and molecular techniques to study gene expression involved in hormone biosynthesis and action during plant growth and development. The understanding of hormone regulation gained will help students promote optimal plant growth under normal and stress conditions, leading to higher productivity, especially in cultivated plants important for food, feed, natural dyes, health, and other uses.
Assessments	The assessment for Selected Topic for Dissertations (Plant Hormone Biosynthesis) is based on three main components, with the respective criteria and weights: A. Participatory Activity (6%) • Stuctured Assigment/Task (6%) B. Project (19%) • Stuctured Assigment/Task (9%) • Project Result/Case Study/Project Based Learning result (10%) C. Kognitif/Knowledge (75%) • Stuctured Assigment/Task (15%) • Quiz (10%) • Mid-Term Exam (25%) • Final-Term Exam (25%)
Study Media and Literature	1. Taiz, L. & Ziegler, 1998. Plant Physiology. Sinauer Associates, Inc. Publishers, Sunderland, Massachusetts. Publishing Company, Belmont, California. Chapter 17 and 18. 2. Salisbury, F.B. and C.W. Ross. 1994. Plant Physiology. Fourth Edition. Wadsworth

3. Fosket, D.E. 1994. Plant Growth and Development. A Molecular Approach. Academic Press INC., San Diego, California.
4. Davies, P.J. 2006. Plant Hormones. Biochemistry, Signal Transduction and Action!. Kluwer Academic Publishers. Dordrecht. Boston, London.
5. Davies, P.J. 1995. Plant Hormones. Physiology, Biochemistry and Molecular Biology. Kluwer Academic Publishers. Dordrecht. Boston, London.

Environmental Microbiology

Course code	BIDB203165
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng.
Lecture(s)	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng. Prof. Dr.Eng. Ir. Wahyu Wilopo S.T., M.Eng., IPM.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203165.1 By the end of this course, students will gain knowledge and understanding of microbial remediation of environmental pollutants. BIDB203165.2 By the end of this course, students will be able to analyze analyze the contribution of microbes to global warming.

	BIDB203165.3 By the end of this course, students will be able to manage, lead, and develop research on pollutant treatment technologies BIDB203165.4 By the end of this course, students will be able to solve human life problems through the application of microbial strains to address environmental issues
Course Description	This course explores microbial activities in environmental biogeochemical cycles, bioremediation, pathogen transmission in the environment, microbial risk assessment, and the treatment and reuse of drinking water. It also addresses key issues such as the contribution of microbes to global warming, the impact of climate change on microbial infectious diseases, the emergence of antibiotic-resistant bacteria, and environmental biotechnology. Additionally, the course covers various environmental microbiology analysis methods, including nucleic acid-based techniques (microarray, phyloarray, real-time PCR, metagenomics, and comparative genomics), as well as physiological methods involving functional genomics and proteomics approaches.
Assessments	The assessment for Selected Topic for Dissertations (Environmental Microbiology) is based on two main components, with the respective criteria and weights: A. Participatory Activity (40%) • Final-Term Exam (30%) • Participation (10%) B. Project (60%) • Stuctured Assigment/Task (10%) • Mid-Term Exam (30%) • Project Result/Case Study/Project Based Learning result (20%)
Study Media and Literature	**Main** 1. Pepper, I., Gerba. C. P., Gentry, T. 2014. Environmental Microbiology. 3rd Edition. Academic Press **Additional** 1. Chen, G., Van Loosdrecht, C, M., Ekama, G. A., Brdjanovic, D. 2020. Biological Wastewater Treatment: Principles, Modelling and Design. IWA Publishing. 2. Pankaj Chowdhary, Abhay Raj, Digvijay Verma, Yusuf Akhter . 2020. Microorganisms for Sustainable Environment and Health. Elsevier.

Bioprocess and Bacterial Biomolecular

Course code	BIDB203167
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng.
Lecture(s)	Prof. Dr. Endah Retnaningrum, S.Si., M.Eng. Prof. Dr. apt. Ratna Asmah Susidarti, M.S.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203167.1 By the end of this course, students gain knowledge and understanding of bacterial diversity from both macroenvironment and microenvironment, including exploration, screening, polyphasic identification, and their applications for human welfare.

	BIDB203167.2 By the end of this course, students will be able to analyze analyze the cellular, metabolic, and genetic characteristics of bacteria and apply this knowledge to assess bacterial communities, particularly in relation to their dissertation research BIDB203167.3 By the end of this course, students will be able to manage, lead, and develop research utilizing bacterial strains with superior traits for bioprocesses in the production of various products, including bacterial enzymes, bioactive compounds, and molecular transformation processes BIDB203167.4 By the end of this course, students will be able to solve human life challenges through bioprocess technology related to the design and development of equipment and processes for producing various products such as functional foods, pharmaceuticals, chemicals, agricultural products, and wastewater treatment.
Course Description	This course studies bacterial diversity from both macroenvironment and microenvironment, including exploration, screening, polyphasic identification, and their applications for human welfare. The study covers cellular, metabolic, and genetic characterization useful for assessing bacterial communities. Additionally, the course examines the utilization of bacterial strains with superior traits in the development of bioprocesses for producing various products, including bacterial enzymes, bioactive compounds, and molecular transformation processes. The course also reviews bioprocess technology related to the design and development of equipment and processes for manufacturing products such as functional foods, pharmaceuticals, chemicals, agricultural products, and wastewater treatment. Recent research related to bacterial diversity is incorporated into each topic, enabling students to analyze and solve relevant problems.
Assessments	The assessment for Selected Topic for Dissertations (Bioprocess and Bacterial Biomolecular) is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Final-Term Exam (30%) • Participation (10%) B. Project (80%) • Mid-Term Exam (30%) • Stuctured Assigment/Task (30%) • Project Result/Case Study/Project Based Learning result (20%)

Study Media and Literature	**Main** 1. Madigan, M.T., Martinko, J.M. & Parker, J. 2000. Biology of Microorganisms, Prentice Hall International,Inc. **Additional** 2. Sivasubramanian, V. 2018. Bioprocess Engineering for a Green Environment. Taylor & Francis Group. 3. Reddy, S. M., Singaracharya, M. A. & Girisham, S. 2021. Microbial Diversity: Exploration & Bioprospecting. Scientific Publishers 4. Kartan, P. 2017. Advances in Bioprocess Technology. Delve Publishing

Ecology

Course code	BIDB203188
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. rer. nat. Andhika Puspito Nugroho, S.Si., M.Si.
Lecture(s)	Prof. Dr. rer. nat. Andhika Puspito Nugroho, S.Si., M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1. Upon completing this program, the graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development; CPL 3.1 After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203188.1 By the end of this course, students will understand the theoretical concepts of Plant Ecology BIDB203188.2 By the end of this course, students will be able to synthesize environmental factors that influence the distribution and abundance of organisms. BIDB203188.3 By the end of this course, students will be able to design and conduct innovative ecological research.

	BIDB203188.4 By the end of this course, students will be able to conduct in-depth observations of ecological problems and formulate scientific solutions based on ecological concepts.
Course Description	This course provides an understanding of theoretical concepts in Ecology, equips students to synthesize the relationships between organisms and their environments that affect organism distribution and abundance, and assists students in designing innovative ecological research, conducting in-depth observations of ecological issues, and formulating scientific solutions based on ecological concepts.
Assessments	The assessment for Selected Topic for Dissertations (Ecology) is based on two main components, with the respective criteria and weights: A. Participatory Activity (50%) • Participation (50%) B. Project (50%) • Project Result/Case Study/Project Based Learning result (50%)
Study Media and Literature	• Krebs, C.J. (1999) Ecological Methodology. 2nd Edition, Benjamin Cummings, Menlo Park, 620 p. • Brewer, R. (1994). The Science of Ecology. Philadelphia: Saunders College Publishing, 1-773. • Brewer, R., & McCann, M. T. (1982). Laboratory and Field Manual of Ecology. Philadelphia: Saunders Publishing. • Odum, E.P. (1971) Fundamentals of Ecology. Third Edition, W.B. Saunders Co., Philadelphia, 1-574.

Plant Physiology

Course code	BIDB203196
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Diah Rachmawati, S.Si., M.Si.
Lecture(s)	Prof. Dr. Diah Rachmawati, S.Si., M.Si. Dr. Tri Rini Nuringtyas, S.Si., M.Sc.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203196.1 By the end of this course, students will be able to study and analyze the cellular and molecular mechanisms of primary and secondary metabolite biosynthesis in plants and their roles in plant growth. BIDB203196.2 By the end of this course, students will be able to integrate and evaluate information related to primary and secondary metabolites in plant development from various sources.
Course Description	This course examines plant growth processes and the cellular and molecular mechanisms underlying each phase of plant development. The topics include primary metabolism related to the synthesis, accumulation, allocation, and partitioning of metabolites and the influencing factors, plant productivity, as well as the biosynthesis and functions of secondary metabolites in plants. It also explores the interaction between internal and environmental

	factors on the biosynthesis of primary and secondary metabolites. By the end of the course, students will be able to analyze and address issues related to the production of primary and secondary metabolites and their roles in plant growth.
Assessments	The assessment for Selected Topic for Dissertations (Plant Physiology) is based on two main components, with the respective criteria and weights: A. Participatory Activity (20%) • Participation (20%) B. Project (80%) • Project Result/Case Study/Project Based Learning result (80%)
Study Media and Literature	1. Bhatla, S.C. & Lal, M.A. 2018. Plant Physiology, Development and Metabolism. Springer. Singapore. 2. Davies, P.J. 2010 Plant Hormone. Biosynthesis, Signal Transduction, Action. Revised 3rd Edition. SpringerDordrecht Heidelberg Londorn New York. 3. Lambers, H., F.S. Chapin III, T.L. Pons. 2008. Plant Physiological Ecology. Springer-Verlag New York, Inc. 4. Marschner, P. 2012. Mineral nutrition of higher plants. Third Edition. Acad Press, London 5. Carocho, M., Heleno, S.A., Barros, L. 2023 Natural Secondary Metabolites. Springer, Cham 6. Westhoff, P. 1998. Molecular plant development from gene to plant. Oxford University Press. 7. Taiz, L. and E. Zieger. 2015. Plant Physiology 5th Ed. Sinauer Associates, Inc., Publisher. Sunderland, Massachusetts.

Nutrition and Metabolism

Course code	BIDB203197
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Woro Anindito Sri Tunjung, S.Si., M.Sc., Ph.D.
Lecture(s)	Woro Anindito Sri Tunjung, S.Si., M.Sc., Ph.D. Prof. Dr. Rarastoeti Pratiwi, M.Sc. Prof. Dr. Yekti Asih Purwestri,M.Si. Dr. Tri Rini Nuringtyas, M.Sc.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	B BIDB203197.1 By the end of this course, students will be able to demonstrate an understanding of the facts, concepts, principles, and prevailing theories in nutritional biochemistry, as well as the role of

	nutrition in society at large and in the scientific community in particular. BIDB203197.2 By the end of this course, students will be able to analyze and solve problems, as well as integrate and evaluate nutritional information and data in living organisms from various sources. BIDB203197.3 By the end of this course, students will be proficient in communicating effectively, written and verbal, as well as through tables and figure, and in utilizing communication and information technologies, particularly in the field of nutritional biochemistry. Students will also be able to apply and integrate various nutritional phenomena into biological sciences and their sub-disciplines. BIDB203197.4 By the end of this course, students will be proficient in utilizing scientific literature to analyze problems in the field of nutritional biochemistry; possess a strong sense of curiosity; value originality in ideas, concepts, and discoveries; and demonstrate respect for diverse interdisciplinary perspectives in exploring, utilizing, and conserving natural resources. Students will also be sensitive to biological changes and issues at global, regional, and local levels.
Course Description	This course explores various aspects of nutritional biochemistry in humans in relation to health issues. The Nutrition and Metabolism lectures cover the types of nutrients (particularly proteins) and their sources, including microorganisms, plants, and animals—as well as the essential roles of nutrients in health and their metabolic processes, including energy balance, malnutrition, and antinutrients. The course also examines nutrigenomics and nutrigenetics to better understand health problems in line with current scientific developments. In addition, it includes a study of functional foods that support health through metabolic pathways, as well as their development and potential in promoting overall well-being

Assessments	The assessment for Selected Topic for Dissertations (Nutrition and Metabolism) is based on five components, with the respective criteria and weights: 1. Presentation Assignment (30%) 2. Mid-Term Exam (20%) 3. Final-Term Exam (20%) 4. Stuctured Assigment/Task (20%) 5. Quiz (10%)
Study Media and Literature	**Main** 1. Whitney E and Rolfes S.R. 2008. Understanding Nutrition. Eleventh Edition (International Student Edition). Thomson, Wadsworth. **Additional** 1. Any journals related to topic

Biochemical Signaling Systems

Course code	BIDB203198
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Yekti Asih Purwestri, M.Si
Lecture(s)	Prof. Dr. Yekti Asih Purwestri, M.Si Prof. Dr. Rarastoeti Pratiwi, M.Sc. Dr. Tri Rini Nurungtyas, M.Sc. Woro Anindito Sri Tunjung, M.Sc., Ph.D.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203198.1 By the end of this course, students will be able to demonstrate comprehensive understanding of biochemical signal transduction pathways including receptors, signaling cascades, and cellular

	responses as a basis for explaining molecular mechanisms of organismal adaptation to biotic and abiotic environmental factors. BIDB203198.2 By the end of this course, Students will be able to integrate fundamental knowledge of biochemical signaling pathways to support the development and advancement of the life sciences. BIDB203198.3 By the end of this course, Students will be able to understand and critically interpret scientific data from journal articles related to biochemical signaling mechanisms underlying adaptation in animals, plants, and microorganisms. BIDB203198.4 By the end of this course, students will be able to use a range of scientific literature to analyze and evaluate issues related to biochemical signaling pathways as mechanisms of adaptation in living organisms. BIDB203198.5. By the end of this course, students will be able to communicate scientific work related to biochemical signaling pathways as mechanisms of organismal adaptation effectively, both in written and oral formats, supported by visual presentations
Course Description	This course aims to explore cellular communication involving signal perception by cellular receptors, signal transduction, and cellular responses that enable organisms (animals, plants, and microorganisms) to adapt to environmental changes. Natural phenomena related to the ability of living organisms to adapt to both biotic and abiotic environments are studied through a molecular approach. The course includes an understanding of fundamental strategies, capacities, and mechanisms of adaptation, with emphasis on the diversity of adaptive patterns and processes mediated by complex biomolecular networks.
Assessments	The assessment for Selected Topic for Dissertations (Biochemical Signaling Pathways) is based on three main components, with the respective criteria and weights: A. Participatory Activity (10%) • Participation (10%) B. Project (40%) • Presentation (25%) • Article (10%) C. Kognitif (50%) • Stuctured Assignment/Task (5%) • Quizz (5%) • Mid-term Exam (20%) • Final-term Exam (20%)

Study Media and Literature	**Main** 7. Berg,J.M., Tymochka, J.L. and L.Stryer, 7th, pdf, W.H. Freeman & Co. 8. Buchanan,B.B.; Gruissem,W. and R.l. Jones, (2001), Biochemistry and Molecular Biology of Plants, 3rd ed. , American Society of Plant Physiologist, Maryland USA 9. Edwards, C ed. (1990), Microbiology of Extreme Environment, Open university Press, Milton Keynes 10. Hochachka, P. and G.N. Somero (1984), Biochemical Adaptation,W.B.Saunders, Princeton University Press, Princeton 11. Hochachka, P. and G.N. Somero (2002), Biochemical adaptation: Mechanism and process physiological evolution. Oxford University Press. 12. Lehninger,A.L.;Nelson, D.l. & M.M.Cox, (2018) Principles of Biochemistry, 4th ed., (pdf) **Additional** 3. Anik Hidayah, Rizka Rohmatin Nisak, Febri Adi Susanto, Tri Rini Nuringtyas, Nobutoshi Yamaguchi, Yekti Asih Purwestri. 2022. Seed Halopriming Improves Salinity Tolerance of Some Rice Cultivars During Seedling Stage. Botanical Studies 63:24 https://doi.org/10.1186/s40529-022-00354-9 4. Alfino Sebastian, Ilham Cahyo Nugroho, Herdin Surya Dwi Putra, Febri Adi Susanto, Putri Wijayanti, Nobutoshi Yamaguchi, Tri Rini Nuringtyas, Yekti Asih Purwestri. 2022. Identification and characterization of drought-tolerant local pigmented rice from Indonesia. Physiol Mol Biol Plants 28(5):1061–1075 https://doi.org/10.1007/s12298022-01185-5

Terrestrial Ecology

Course code	BIDB243030
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. rer. nat. Andhika Puspito Nugroho
Lecture(s)	Prof. Dr. rer. nat. Andhika Puspito Nugroho Siti Nurleily Marliana, Ph.D. Mukhlish Jamal Musa Holle, D.Phil.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. pon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction

Course Learning Outcome	BIDB243030.1 By the end of this course, students will be able to explain the fundamental concepts underlying ecology. BIDB243030.2 By the end of this course, students will be able to explain the characteristics and dynamics of ecological communities, both spatially and temporally, along with the factors that shape them. BIDB243030.3 By the end of this course, students will be able to identify and explain the biotic environmental factors that influence the dynamics of ecological communities, including species interactions and the evolutionary history that shapes the types and persistence of these interactions. BIDB243030.4 By the end of this course, students will be able to explain the types and mechanisms of abiotic environmental factors that influence the formation and sustainability of ecological communities BIDB243030. 5 By the end of this course, students will be able to demonstrate an understanding of the application of fundamental ecological principles in species conservation strategies; identify and synthesize current issues related to global ecological community challenges driven by human activities; and critically consider potential solutions and anticipatory measures to address these problems. BIDB243030. 6 By the end of this course, students will be able to demonstrate mastery of the topics studied by effectively communicating ideas and reflections on various environmental issues, both orally and in written form
Course Description	Terrestrial Ecology introduces students to the understanding of processes and patterns within ecological communities by integrating key concepts from ecology, biogeography, biodiversity, conservation, and other relevant scientific disciplines. The course offers both theoretical and experimental approaches, supported by a range of real-world case studies. Overall, this course aims to provide students with a comprehensive and up-to-date understanding of community ecology, including the historical development of the scientific knowledge that shapes current perspectives in the field. Topics covered include the concept of ecological communities, community stability (succession), species interactions (mutualism, competition, predation, and energy flow in trophic chains), island biogeography, metacommunities, and

	the effects of environmental change due to human activities—such as invasive species and disturbances—on ecological communities.
Assessments	The assessment for Selected Topic for Dissertations (Terrestrial Ecology) is based on three main components, with the respective criteria and weights: A. Participatory Activity (25%) • Participation (25%) B. Project (25%) • Project Result/Case Study/Project Based Learning result (25%) C. Kognitif • Quiz (10%) • Mid-term Exam (20%) • Final-term Exam (20%)
Study Media and Literature	**Main** 1. Audesirk T, Audesirk G, Byers BE. 2017. Biology: Life on earth with physiology. 11th edition. Essex (UK): Pearson Education. 2. Gotelli NJ. 2008. A primer of ecology. 4th ed. Sinauer Associates. 3. Molles MC Jr. 2016. Ecology: concepts and applications, 7th edition, NY: McGraw-Hill Education. 4. Morin PJ. 2011. Community ecology. 2nd ed. Chichester: Wiley-Blackwell. 5. Ricklefs RE. 2008. The Economy of Nature. 6th ed. NY: W. H. Freeman and Company. 6. Smith TM & Smith RL. 2015. Elements of Ecology. 9th ed. Essex (UK): Pearson Education Ltd. **Additional** 1. Begon M, Townsend CR, Harper JL. 2006. Ecology: from individuals to ecosystems. 4th ed. Chichester: Wiley-Blackwell. 2. Any journals related to topic

Ecotoxicology

Course code	BIDB243031
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. rer. nat. Andhika Puspito Nugroho
Lecture(s)	Prof. Dr. rer. nat. Andhika Puspito Nugroho Siti Nurleily Marliana, Ph.D. Mukhlish Jamal Musa Holle, D.Phil.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction

Course Learning Outcome	BIDB243031.1 By the end of this course, students will have knowledge and understanding of the fundamental principles of ecotoxicology BIDB243031.2 By the end of this course, students will be able to advance knowledge and technology in the field of ecotoxicology, particularly in relation to dissertation research. BIDB243031.3 By the end of this course, students will be able to manage, lead, and develop research in the field of ecotoxicology. BIDB243031.4 By the end of this course, students will be able to solve problems in the field of ecotoxicology through inter- and multidisciplinary approaches.
Course Description	This course explores the scope of ecotoxicology, including the classification of toxicants, toxicant emissions, intra- and inter-compartment transport of toxicants, the fate of toxicants in individuals (bioaccumulation, bioconcentration, biodegradation) and ecosystems, toxicant fate models, toxicokinetics and toxicodynamics, biomarkers and bioindicators, and the effects of toxicants at the molecular, individual, population, and community levels. It also covers toxicity testing and biomonitoring. Each topic is discussed in reference to current developments in ecotoxicology, with an emphasis on real-world cases and issues. Through assignments and projects, students will identify and analyze ecotoxicological cases and propose appropriate solutions..
Assessments	The assessment for Selected Topic for Dissertations (Ecotoxicology) is based on four components, with the respective criteria and weights: 1. Mid-term Exam (25%) 2. Final-term Exam (25%) 3. Project 1 (25%) 4. Project 2 (25%)
Study Media and Literature	**Main** 1. Newman, M.C. 2015. Fundamental of ecotoxicology. CRC Press, Inc. USA. **Additional** 3. Manahan, S.E. 2013. Fundamentals of environmental and toxicological chemistry. CRC Press, Inc. USA. 4. Walker, C.H., S.P. Hopkin, R.M. Sibly, and D.B. Peakall. 2001. Priciples of ecotoxicology. 2nd edition. Taylor & Francis, Inc. New York.

5. Leeuwen, C.J.V. and J.L.M Herments (eds). 1995. Risk assessment of chemicals: an introduction. Kluwer Academic Publisher. Netherlands.
6. Manahan, S.E. 1994. Environmental Chemistry. Sixth edition. CRC Press, Inc. USA.

Cellular and Molecular Immunobiology

Course code	BIDB203004
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr.biol.hom. Nastiti Wijayanti, S.Si., M.Si
Lecture(s)	Prof. Dra. Rarastoeti Pratiwi, M.Sc., Ph.D Dr. Slamet Widiyanto, S.Si., M.Sc Dr.biol.hom. Nastiti Wijayanti, S.Si., M.Si Dr. Fajar Sofyantoro, S.Si., M.Sc
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1. Upon completing this program, the graduates demonstrate an attitude of being able to discover or develop new scientific theories/concepts/ideas in biology CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology; CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB243040.1 By the end of this course, students will have knowledge of the body's defense systems, and understand the differences between humoral and

	cellular immunity, as well as between innate and adaptive immune systems. BIDB243040.2 By the end of this course, students will understand the mechanisms and regulation of immune responses through both cellular and molecular components. BIDB243040.3 By the end of this course, students will be able to design research and understand the parameters and methods required for its analysis.
Course Description	This course explores the concepts of the body's defense mechanisms against antigens, including how immune responses are initiated and how the body activates components of the immune system cellular and humoral at the levels of innate and adaptive immunity. It provides students with foundational knowledge of the parameters and methodologies that can be applied to investigate immune defense mechanisms at the molecular and cellular levels.
Assessments	The assessment for Selected Topic for Dissertations (Cellular and Molecular Immunobiology) is based on five components, with the respective criteria and weights: • Participatory Activity (10%) • Literature Review (25%) • Result Design of Research Roadmap (10%) • Mid-term Exam (25%) • Research Proposal Draft in the field of imunobiology (30%)
Study Media and Literature	**Main:** 1. Cellular and Molecular Immunology, 8th edition, 2015. Abul Abbas, Andrew Lichtman and Shiv Pillai, Elsevier. 2. Basic Immunology. Edisi ke 5. 2016. Abul K Abbas, Andrew H. Lichtman dan Shiv Pillai. Elsevier. 3. Immunobiology. 5th edition. 2001. Charles A Janeway, Jr, Paul Travers, Mark Walport, and Mark J Shlomchik. Garland Science, New York. ISBN-10: 0-8153-3642-X **Additional** 1. Any reputable journals related to Imunobiology topic

Plant Development Physiology

Course code	BIO-80902
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Diah Rachmawati, S.Si., M.Si.
Lecture(s)	Prof. Dr. Diah Rachmawati, S.Si., M.Si. Prof. Dr. Kumala Dewi, M.Sc.St.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIO-80902.1 By the end of this course, students will be able to explain the cellular and molecular mechanisms involved in various plant developmental processes. BIO-80902.2 By the end of this course, students will be able to integrate and critically evaluate information from various sources related to plant developmental physiology.

	BIO-80902.3 By the end of this course, students will be able to analyze issues related to plant developmental physiology and communicate their findings effectively, making appropriate use of information technology.
Course Description	This course examines plant developmental processes and the underlying cellular and molecular mechanisms at each phase of plant growth. It explores genetic and hormonal regulation in development, gene expression analysis, and plant responses to various environmental conditions from cellular, molecular, biochemical, and physiological perspectives. This course provides a comprehensive understanding of plant developmental mechanisms by addressing key developmental stages throughout the plant life cycle from seed development, germination, and growth of juvenile and mature plants, to reproduction and senescence as well as the internal and external factors influencing these processes.
Assessments	The assessment for Selected Topic for Dissertations (Plant Developmental Physiology) is based on three Component, with the respective criteria and weights: A. Mid-term Exam (20%) B. Final-term Exam (20%) C. Participatory Activity • Presentation (20%) • Case Study (40%)
Study Media and Literature	**Main:** 1. Davies, P.J. 2010 Plant Hormone. Biosynthesis, Signal Transduction, Action. Revised 3rd Edition. SpringerDordrecht Heidelberg Londorn New York. 2. Leyser, O & Day, S. 2002. Mechanism in Plant Development. Blackwell Science, UK 3. Lambers, H., F.S. Chapin III, T.L. Pons. 2008. Plant Physiological Ecology. Springer-Verlag New York, Inc. 4. Marschner, P. 2012. Mineral nutrition of higher plants. Third Edition. Acad Press, London 5. Pessarakli, M. 2014. Handbook of Plant and Crop Physiology. 3rd Edition. CRC Press. Taylor & Francis Group. Boca Raton London New York 6. Westhoff, P. 1998. Molecular plant development from gene to plant. Oxford University Press. 7. Taiz, L. and E. Zieger. 2015. Plant Physiology 5th Ed. Sinauer Associates, Inc., Publisher. Sunderland, Massachusetts **Additional:**

	1. Bewley, I. D & M. Black 1994. Seeds. Physiology of development and germination. Plenum Press, N. York 2. Pareek, A., Sopory, S.K., Bohnert, H.J. and Govindjee. 2010. Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation. Springer. The Netherlands.

Diversity of Fungi and Lichens

Course code	BIDB243057
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Rina Sri Kasiamdari, S.Si., Ph.D.
Lecture(s)	Prof. Rina Sri Kasiamdari, S.Si., Ph.D Dr. Miftahul Ilmi, M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology. CPL 2.2. After attending this program, graduates will understand of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB243057.1 By the end of this course, students will be able to understand the diversity and characteristics of fungi and lichens. BIDB243057.2 By the end of this course, students will be able to understand the taxonomy of fungi and lichens, including identification, classification, and nomenclature.

	BIDB243057.3 By the end of this course, students will be able to understand the physiology, reproduction, and ecology of fungi and lichens BIDB243057.4 By the end of this course, students will be able to demonstrate the ability to conduct research related to fungi and lichens, as well as to perform comprehensive literature reviews
Course Description	This course explores the diversity of fungi and lichens, including techniques for isolation, cultivation, and preservation. It covers key morphological characteristics essential for identification, as well as morphological and molecular identification methods for fungi and lichens. The course also discusses current classification systems and nomenclature of fungi and lichens. In addition, students will study fungal physiology, reproduction, and ecology. Research methodologies related to fungi and lichens, along with critical reviews of relevant scientific journal articles, are also integral components of this course.
Assessments	The assessment for Selected Topic for Dissertations (Diversity of Fungi and Lichens) is based on three components, with the respective criteria and weights: • Stuctured Assigment/Task (35%) • Mid-Term Exam (35%) • Final-Term Exam (30%)
Study Media and Literature	1. Watkinson, S. C., Boddy, L., & Money, N. P. (2016). The Fungi (Third Edition). Academic Press. 2. Foster, M. S., Bills, G. F., & Mueller, G. M. (2011). Biodiversity of Fungi: Inventory and Monitoring Methods. Burlington: Elsevier Science. 3. Deacon J.W. (1994). Modern Mycology, Edinburg, UK 4. Huneck, S., Yoshimura I. (1996). Identification of Lichen Substances. Springer. 5. Nash, T.H., (2008). Lichen Biology. Cambridge University Press 6. Any Journals related to topic

Comparative Anatomy and Evolution

Course code	BIDB203007
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Bambang Retnoaji, S.Si., M.Sc.
Lecture(s)	Prof. Dr. Bambang Retnoaji, S.Si., M.Sc. Susilohadi, S.Si., M.Si., Ph.D. Zuliyati Rohmah, S.Si., M.Si., Ph.D. Eng.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 2.1. After attending this program, graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems CPL 3.3. After completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism CPL 4.1. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable

	manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction
Course Learning Outcome	BIDB203007.1 By the end of this course, students will be able to identify and analyze the anatomical structures of various animal groups through a comparative approach, with emphasis on evolutionary relationships and morphological adaptations. BIDB203007.2 By the end of this course, students will be able to integrate fundamental and advanced evolutionary concepts such as natural selection, homology, analogy, morphological convergence, and divergence within the context of comparative animal anatomy. BIDB203007.3 By the end of this course, students will be able to apply modern techniques, including geometric morphometrics, molecular phylogenetic analysis, and high-resolution imaging, to study and understand morphological changes in animals within an evolutionary context BIDB203007.4 By the end of this course, students will be able to formulate relevant and innovative research questions related to animal anatomy and evolution, and design appropriate experiments to address those questions. BIDB203007.5 By the end of this course, students will be able to critically analyze and interpret research data with a high degree of accuracy, and present scientific findings in a manner that supports the development of a significant dissertation in the field of animal anatomy and evolution BIDB203007.6 By the end of this course, students will be able to develop novel hypotheses related to the evolution of biological structures in animals and test these hypotheses through critical and systematic research approaches
Course Description	This course provides an academic platform for in-depth and critical examination of anatomical structures across various animal groups, with emphasis on evolutionary relationships and morphological adaptations. Designed for doctoral students engaged in dissertation research, the course integrates fundamental and advanced evolutionary principles such as natural selection, homology, analogy, and mechanisms of morphological convergence and divergence. Through a comparative approach, students will explore morphological variation and transformation from an evolutionary

	perspective, spanning individual organs to complex biological systems. The course also incorporates the application of modern techniques in anatomical and evolutionary studies, including geometric morphometrics and high-resolution imaging. Students will be guided in formulating relevant research questions, designing experiments, and analyzing and interpreting data, with the aim of supporting the development of a dissertation that makes a significant scientific contribution to the field of animal anatomy and evolution. This course emphasizes the development of novel hypotheses on the evolution of biological structures and prepares students to become leaders in research within this discipline.
Assessments	The assessment for Selected Topic for Dissertations (Comparative Anatomy and Evolution) is based on four components, with the respective criteria and weights: 1. Stuctured Assigment/Task (40%) 2. Presentation/Project (40%) 3. Mid-Term Exam (10%) 4. Final-Term Exam (10%)
Study Media and Literature	**Main** 1. Kardong, K. V. (2019). Vertebrates: Comparative anatomy, function, evolution (8th ed.). McGraw-Hill Education. 2. Hall, B. K. (2014). Evolutionary developmental biology (2nd ed.). Springer. 3. Romer, A. S., & Parsons, T. S. (1986). The vertebrate body (6th ed.). Saunders College Publishing.. **Additional** 1. Gilbert, S. F., & Barresi, M. J. (2016). Developmental biology (11th ed.). Sinauer Associates, Inc.. 2. Pough, F. H., Janis, C. M., & Heiser, J. B. (2013). Vertebrate life (9th ed.). Pearson.

Microscopy and Animal Models

Course code	BIDB243065
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Bambang Retnoaji, S.Si., M.Sc.
Lecture(s)	Prof. Dr. Bambang Retnoaji, S.Si., M.Sc. Dr. Ardaning Nuriliani, M.Kes. Dr. med.vet. Hendry Saragih, M.P. Zuliyati Rohmah, S.Si., M.Si., Ph.D.Eng. Susilohadi, S.Si., M.Si., Ph.D Nur Indah Septriani, S.Si., M.Sc., Ph.D.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 2.1. After attending this program, graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems CPL 3.3. After completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism CPL 4.1. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions

	to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction
Course Learning Outcome	BIDB243065.1 By the end of this course, students will be able to understand the basic concepts and the role of model organisms in biological and biomedical research. BIDB243065.2 By the end of this course, students will be able to identify commonly used model organisms and explain the rationale for their use in research. BIDB243065.3 By the end of this course, students will be able to demonstrate proficiency in the safe, ethical, and protocol-compliant handling, euthanasia, and treatment of model organisms. BIDB243065.4 By the end of this course, students will be able to understand and apply macroscopic and microscopic parameters in analyzing the structure and function of tissues in model organisms. BIDB243065.5 By the end of this course, students will be able to demonstrate proficiency in cellular and molecular techniques and analyses to understand biological processes in model organisms. BIDB243065.6 By the end of this course, students will be able to apply ethical principles and Good Laboratory Practice (GLP) in the use and management of model organisms
Course Description	This course is designed to provide advanced knowledge and skills related to the use of model organisms in biological and related scientific research. It covers a range of microscopy techniques commonly applied in model organism studies. Students will learn about key model organisms such as mice, Rasbora fish, and zebrafish, including technical aspects such as handling, euthanasia, treatment, and appropriate sampling methods. The course also introduces microscopic analysis of tissues and structures in model organisms. Advanced microscopy techniques including light microscopy, fluorescence, confocal, and electron microscopy will be discussed in depth, enabling students to understand and apply these tools within scientific research contexts. In addition, the course emphasizes ethical considerations in the use of animals for research, highlighting the importance of sustainable and responsible research practices. By the end of the course, students are expected to be able to apply both theoretical and practical skills in research projects, with a deeper understanding of the role of model organisms and microscopy in biological and biomedical studies.

Assessments	The assessment for Selected Topic for Dissertations (Microscopy and Model Organismsis based on four components, with the respective criteria and weights: 1. Stuctured Assigment/Task (40%) 2. Presentation/Project (40%) 3. Mid-Term Exam (10%) 4. Final-Term Exam (10%)
Study Media and Literature	**Main** 1. Kardong, K. V. (2019). Vertebrates: Comparative anatomy, function, evolution (8th ed.). McGraw-Hill Education. 2. Hall, B. K. (2014). Evolutionary developmental biology (2nd ed.). Springer. 3. Romer, A. S., & Parsons, T. S. (1986). The vertebrate body (6th ed.). Saunders College Publishing.. **Additional** 1. Gilbert, S. F., & Barresi, M. J. (2016). Developmental biology (11th ed.). Sinauer Associates, Inc.. 2. Pough, F. H., Janis, C. M., & Heiser, J. B. (2013). Vertebrate life (9th ed.). Pearson.

Structure and Products of Plant Secretory Tissues

Course code	BIDB243069
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. L. Hartanto Nugroho M.Agr.
Lecture(s)	Prof. Dr. L. Hartanto Nugroho M.Agr. Dr. Maryani M.Sc.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology CPL 3.3. After completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism

	CPL 4.3. After participating in this program, graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB243069.1 By the end of this course, students will be able to Apply the concepts and working principles of the Structure and Products of Plant Secretory Tissues to investigate the biosynthetic pathways of various secondary metabolites, the characteristics of each metabolite group, their sites of synthesis and accumulation, and the methods for analyzing the distribution of secondary metabolites in plant tissues through doctoral-level research. BIDB243069.2 By the end of this course, students will be able to determine appropriate data types and data collection methods in accordance with dissertation research objectives within the scope of the Structure and Products of Plant Secretory Tissues. BIDB243069.3 By the end of this course, students will be able to develop or modify and innovate research methods to achieve dissertation research objectives within the scope of the Structure and Products of Plant Secretory Tissues BIDB243069.4 By the end of this course, students will be able to demonstrate the ability to select and apply appropriate data analysis methods and interpret the results to address research problems and achieve dissertation objectives within the scope of the Structure and Products of Plant Secretory Tissues, including proficiency in using software tools for analyzing the localization of secondary metabolites in plants
Course Description	This course examines the cells and tissues involved in the accumulation of secondary metabolites in plants. The course explores secretory tissues based on their biosynthetic stages and secretory products, the classification of secondary metabolites by molecular structure and metabolic pathways, and various analytical methods for determining the localization of secondary metabolites within plant cells, tissues, and organs

Assessments	The assessment for Selected Topic for Dissertations (Structure and Products of Plant Secretory Tissues) is based on four components, with the respective criteria and weights: 1. Stuctured Assigment/Task (20%) 2. Presentatiom (20%) 3. Mid-Term Exam (30%) 4. Final-Term Exam (30%)
Study Media and Literature	**Main** 1. Nugroho, L. H. 2017. Strukur dan produk jaringan sekretori tumbuhan. Universitas Gadjah Mada Press. Indoenesia 2. Fahn, A. 1979. Secretory Tissues in Plants. Academic Press. London. 3. Dewick, P.M. 2008. Midicinal natural product: A biosyntesis approach. John Wiley and Sons Ltd. Chichester. 4. Samuelsson, G. 1999. Drug of Natural Origin. Swedish Pharmaceutical Society. Swedish Pharmaceutical Press. Sweden. **Additional** 1. Nugroho, L. H. dan Hartini, YS. 2020. Farmakognosi Tumbuhan Obat: Kajian Spesifik Genus Piper. Universitas Gadjah Mada Press. Indonesia 2. Nugroho, L. H. dan Hartini, YS. 2024. Tumbuhan Obat Antidiabetik: Etnomedisin, Ramuan, dan Mekanisme Aksi. Universitas Gadjah Mada Press. Indonesia.

Plant Molecular Biology

Course code	BIDB203148
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Endang Semiarti, M.S., M.Sc.
Lecture(s)	Prof. Dr. Endang Semiarti, M.S., M.Sc.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development; CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203148.1 By the end of this course, students will be able to apply fundamental concepts, principles, and theories related to the structure, function, engineering, diversity, reproduction, and evolution of

	plants within biological systems at the molecular level. BIDB203148.2 By the end of this course, students will be able to conduct in-depth and extensive studies in the field of biology to develop original, tested, and innovative models, methods, or theoretical advancements in plant molecular biology through research employing interdisciplinary, multidisciplinary, or transdisciplinary approaches. BIDB203148.3 By the end of this course, students will be able to propose new solutions or recommending proposed solutions to address problems related to plants as biological resources in a sustainable manner through deductive and/or inductive approaches in an interdisciplinary or multidisciplinary context, based on plant molecular biology
Course Description	This course explores molecular biological mechanisms used to study and address developmental processes in both monocot and dicot plants. Topics include the molecular basis of plant development, gene structure and interaction models, and molecular approaches to studying cell division and key developmental stages such as pollination, fertilization, embryogenesis, meristem activity, organogenesis, shoot and root formation, and flowering. The course also covers hormone signaling, plant responses to biotic and abiotic stresses during in vitro culture, and regeneration processes in genetic engineering techniques.
Assessments	The assessment for Selected Topic for Dissertation (Plant Molecular Biology) is based on participatory activity, with the respective criteria and weights: • Stuctured Assigment/Task (10%) • Mid-term Examination (30%) • Final-term Examination (40%)
Study Media and Literature	**Main:** - Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K.,Watson, J.D. (2016). Molecular Biology of The Cell. 5th ed. Garland Publ. Inc., New York. - Semiarti, E., Indrianto, A.,Purwantoro, A., Machida, Y, and Machida C. (2011) Agrobacterium-Mediated Transformation of Indonesian Orchids for Micropropagation, Chapter 11 in: Scientific e-book Genetic Transformation ISBN 978-953-307-364-4, ed by M.Alvarez, InTech-Open Publisher, DOI http://dx.doi.org/10.5772/intechopen.103839

- Semiarti, E., Y.A. Purwestri, S. Rohman, and W.A. Putri (2022). Genetic Transformation in Prokaryotic and Eukaryotic Cells. Chapter 2 in "Molecular Cloning", p 27-46, ed.by Sadik Dincer, IntechOpen Publisher, Print ISBN 978-1-80355-450-1, ISBN 978-1-80355-451-1, DOI: http://dx.doi.org/10.5772/intechopen.103839
- Semiarti, E., Y.A. Purwestri, S. Rohman, and W.A. Putri (2023). Bioteknologi Tanaman, Gadjah Mada University Press, 1-178 halaman. ISBN: 978-623-359-167-6.

Additional

- Semiarti,E., S.Nopitasari, Y. Setiawati, M.D. Lawrie, A. Purwantoro, J. Widada, K. Ninomiya, Y. Asano, S. Matsumoto, Y.Yoshioka (2020). Application of CRISPR/Cas9 genome editing system for molecular breeding of orchids. Indones J Biotechnol 25(1), 2020, 61?68 | DOI 10.22146/ijbiotech.39485, www.jurnal.ugm.ac.id/ijbiotech
- Semiarti E., Indrianto A., Purwantoro A., Martiwi I. N. A., Feroniasanti Y. M. L., Nadifah F., Mercuriana I. S., Dwiyani R., Iwakawa H., Yoshioka Y., Machida Y. and Machida C. (2010). High-frequency genetic transformation of Phalaenopsis amabilis orchid using tomato extract-enriched medium for the pre-culture of protocorms. The Journal of Horticultural Science and Biotechnology, Vol. 85 No. 3: 205-210 (2010)
- Semiarti, E., Indrianto A, Purwantoro A., Isminingsih S., Suseno N., Ishikawa T., Yoshioka Y., Machida Y., and Machida C. 2007. Agrobacteriummediated transformation of the wild orchid species Phalaenopsis amabilis. Plant Biotechnology.Vol. 24. No.3 th

Analytical Biochemistry

Course code	BIDB203117
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Rarastoeti Pratiwi, M.Sc
Lecture(s)	Prof. Dr. Rarastoeti Pratiwi, M.Sc. Prof. Dr. Yekti Asih Purwestri, M.Si. Dr. Tri Rini Nuringtyas, M.Sc. Dr. Woro Anindito Sri Tunjung, M.Sc. Prof. Dr. L. Hartanto Nugroho, M.Agr.Sc.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.2. Upon completing this program, the graduates demonstrate an attitude of being able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203117.1 By the end of this course, students will be able to develop an understanding of the relationships between facts, concepts, principles, and theories particularly those derived from the fundamental principles of biochemistry in order to comprehend and analyze biomolecules more comprehensively, and to elucidate biological phenomena. BIDB203117.2 By the end of this course, students will be able to to apply biomolecular analysis methods to address

	relevant problems, and to integrate and critically evaluate information and data from various sources regarding biomolecular analysis processes in living organisms. BIDB203117.3 By the end of this course, students will be able to formulate and design appropriate research methodologies relevant to their dissertation work.
Course Description	This course provides an advanced exploration of biomolecular analysis, covering sample preparation techniques with an emphasis on ensuring data validity and accuracy through precise and accurate measurements. It addresses the influence of both micro- and macro-environmental conditions during biomolecular analysis, the importance of achieving sample homogeneity both in intact cells and extracted materials and the critical conditions affecting extraction, fractionation, and analysis of bioactive compounds. The course also includes techniques for the isolation and purification of DNA, RNA, and proteins, as well as radioisotope labeling and tracing.
Assessments	The assessment for Selected Topic for Dissertations (Analytical Biochemistry) is based on four components, with the respective criteria and weights: 1. Presentation Assignment (30%) 2. Mid-term Exam (20%) 3. Final-term Exam (20%) 4. Structured Assignment/task (20%) 5. Quiz (10%)
Study Media and Literature	**Main** 1. Wilson, K. And Walker, J. 2011. Principles and Technique of Biochemistry and Molecular Biology. Seventh Edition. Cambridge University Press (e-book) 2. Altemimi, A. Lakhssassi, N. Baharlouei, A, Watson, D.G. and Lightfoot, D.A. 2017.Principles and Technique of Biochemistry and Molecular Biology. Seventh Edition. Cambridge University Press (e-book) **Additional** 1. Review: Phytochemicals: Extraction, Isolation, and Identification of Bioactive Compounds from Plant Extracts. MDPI (e-journal) 2. Course material from lecturer (PPT, Vidio, etc) and any journals related to topic

Organogenesis and Teratology

Course code	BIDB203009
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof.Dr. Bambang Retnoaji, S.Si., M.Sc.
Lecture(s)	Dr.med.vet. drh. Hendry Saragih, M.P. Prof.Dr. Bambang Retnoaji, S.Si., M.Sc. Zuliyati Rohmah, S.Si., M.Si., Ph.D.Eng. Dr. Ardaning Nuriliani, S.Si., M.Kes.
Language	Indonesian/English
Classification within the Curriculum	Selected Topic For Dissertations
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	90 hours
Credits	2-0 credits / 3.6 ECTS
Requirements	Receiving approval from the Supervisory Team.
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology. CPL 2.2. After attending this program, graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology
Course Learning Outcome	BIDB203009.1 By the end of this course, Students will be able to understand the basic concepts, principles, and theories related to the formation of functional organs; comprehend reproduction and organogenesis in animals from a molecular perspective; and explain the stages of embryonic development in relation to the sensitivity to external or environmental factors that may cause abnormalities in organ structure or damage to normal cells and tissues. BIDB203009.2 By the end of this course, Students will be able to understand gene regulation in gametogenesis and organogenesis, as

	well as comprehend the potential of chemicals, infectious agents, and drugs as teratogenic agents and their mechanisms of interaction. BIDB203009.3 By the end of this course, Students will be able to analyze cases of developmental abnormalities and structural defects in animal organs caused by teratogens or other toxic factors.
Course Description	This course provides an understanding of organ formation processes during embryonic development in animals and humans, as well as structural and developmental abnormalities. Topics covered include reproduction, molecular perspectives on organ formation (organogenesis), and gene regulation during gametogenesis and organogenesis, leading to the development of functional organs, along with the mechanisms regulating organ formation. This course also examines developmental abnormalities, focusing on substances with potential teratogenic effects on embryos and their mechanisms of action. Special emphasis is placed on the causes of developmental disorders, teratogenic substances and drugs, and maternal conditions that may result in abnormal embryonic development.
Assessments	The assessment for Selected Topic for Dissertations (Organogenesis and Teratology) is based on three main components, with the respective criteria and weights: H. Partisipatory Activity (20% I. Project Result/Case Studi result/PBL Result (30%) J. Kognitif • Assignment (5%) • Quizz (5%) • Mid-term Exam (20%) • Final-term Exam (20%)
Study Media and Literature	**Main**: a. https://embryology.med.unsw.edu.au/embryology/index.php/Animal_Development b.https://embryo.asu.edu/pages/embryonic-differentiation-animals c.http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EmbryonicDevelopment.html d.http://www.britannica.com/science/animal-development e.http://www.britannica.com/science/animal-development/Organ-formation f.Lutz Slomianka, 2009, Blue Histology, University of Western Australia, http://www.lab.anhb.uwa.edu.au/mb140/ g.http://www.embryology.ch/genericpages/moduleorganoen.html **Addition**: 1.https://www.cdc.gov/ncbddd/birthdefects/surveillancemanual/chapters/chapter-1/chapter1-4.html 2.https://www.who.int/news-room/fact-sheets/detail/congenital-anomalies 3.https://www.cdc.gov/ncbddd/fasd/index.html 4.https://embryology.med.unsw.edu.au/embryology/index.php/Abnormal_Development_-_Thalidomide 5. https://embryo.asu.edu/pages/retinoids-teratogens

	6. https://stemcells.nih.gov/ 7. https://www.diabetes.org/diabetes

Infection Biology

Course code	BIDB243053
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr.rer.nat. Abdul Rahman Siregar, S.Si., M.Bioetch.
Lecture(s)	Dr.rer.nat. Abdul Rahman Siregar, S.Si., M.Bioetch. Wahyu Aristyaning Putri, S.Si., M.Sc., Ph.D.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology;
Course Learning Outcome	BIDB243053.1 By the end of this course, students will be able to understand the basic concepts, principles, and theories of functional organ formation, reproduction, and organogenesis in animals at the molecular level, and recognize the stages of embryonic development in relation to environmental factors influencing structural and cellular abnormalities. BIDB243053.2 By the end of this course, students will be able to understand gene regulation in gametogenesis and

	organogenesis, and recognize chemicals, infectious agents, and drugs with teratogenic potential along with their mechanisms of interaction. BIDB243053.3 By the end of this course, students will be able to demonstrate the ability to analyze developmental and structural abnormalities in animal organs caused by teratogens or other toxic factors BIDB243053.4.
Course Description	This course provides an understanding of the processes of organ formation during embryonic development in animals and humans, as well as structural and developmental abnormalities. Topics include reproduction and organogenesis from a molecular perspective, gene regulation in gametogenesis and organogenesis, and the mechanisms governing the formation of functional organs. The course also covers developmental abnormalities, focusing on substances with teratogenic potential, their mechanisms of action, drugs and chemicals that may cause developmental defects, and maternal conditions that contribute to embryonic abnormalities.
Assessments	The assessment for Selected Topic for Dissertations (Organogenesis and Teratology) is based on three main components, with the respective criteria and weights: • Participatory Activity (20%) • Project Results / Case Study Results / PBL Results (30%) • Kognitif - Assignment (5%) - Quizzes (5%) - Mid-Term Exam (20%) - Final-term Exam (20%)
Study Media and Literature	**Main:** a. https://embryology.med.unsw.edu.au/embryology/index.php/Animal_Development b. https://embryo.asu.edu/pages/embryonic-differentiation-animals c.http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EmbryonicDevelopment.html d. http://www.britannica.com/science/animal-development e. http://www.britannica.com/science/animal-development/Organ-formation f. Lutz Slomianka, 2009, Blue Histology, University of Western Australia, http://www.lab.anhb.uwa.edu.au/mb140/ g. http://www.embryology.ch/genericpages/moduleorganoen.html **Addition:** 1. https://www.cdc.gov/ncbddd/birthdefects/surveillancemanual/chapters/chapter-1/chapter1-4.html 2. https://www.who.int/news-room/fact-sheets/detail/congenital-anomalies 3. https://www.cdc.gov/ncbddd/fasd/index.html 4. https://embryology.med.unsw.edu.au/embryology/index.php/Abnormal_Development_-_Thalidomide 5. https://embryo.asu.edu/pages/retinoids-teratogens 6. https://stemcells.nih.gov/ 7. https://www.diabetes.org/diabetes

Biosystematic and Animal Diversity

Course code	BIDB243055
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr. Rury Eprilurahman, S.Si., M.Sc.
Lecture(s)	Dr. Rury Eprilurahman, S.Si., M.Sc. Dr. Dra. Rr. Upiek Ngesti Wibawaning Astuti, B.Sc., DAP&E. M.Biomed. Dr. Dwi Sendi Priyono, S.Si, M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila; CPL 2.1. After attending this program, graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology

Course Learning Outcome	BIDB243055.1 By the end of this course, students will be able to demonstrate knowledge and understanding of the basic principles of biosystematics and animal biodiversity.. BIDB243055.2 By the end of this course, students will be able to develop knowledge and technology in the field of biosystematics and animal biodiversity, particularly in relation to dissertation research. BIDB243055.3 By the end of this course, students will be able to manage, lead, and develop research in the field of animal biosystematics and biodiversity. BIDB243055.4. By the end of this course, students will be able to apply inter- and multidisciplinary approaches to solve problems in biosystematics and animal biodiversity.
Course Description	This course examines the concepts and methods of biosystematics and animal diversity in relation to the selected dissertation taxon. Topics include taxonomic principles, phenotypic and genotypic variation in animals, species concepts, adaptation and speciation, phylogenetics, and evolutionary mechanisms specific to the studied taxon. Students will explore techniques for identifying, classifying, and analyzing animal biodiversity, as well as the conservation implications of biodiversity. Each topic also refers to current developments in animal biosystematics and real-world case studies related to the dynamic changes and discoveries of new species. Through assignments and projects, students will identify and analyze cases in biosystematics and animal biodiversity.
Assessments	The assessment for Selected Topic for Dissertations (Biosystematic and Animal Diversity) is based on four components, with the respective criteria and weights: - Mid-Term Exam (25%) - Final-term Exam (25%) - Project 1 (25%) - Project 2 (25 %)
Study Media and Literature	**Main:** 1.Camp, W.H. and Gilly, C.L.: 1943, 'The Structure and Origin of Species', Brittonia 4, 323– 385. 2. Hennig, W. 1966. Phylogenetics Systematics, trnas. D.D.nDavisand R. angerl. Urbana: University of Illinois Press. 3.Lincoln, R.J., G.A. Boxhall, P.F. Clark. 1982. A Dictionary of Ecology, Evolution and Systematics. Cambridge University Press. Cambridge. 4.Marhold, K. and Tod F. Stuessy, 2011. Modern Plant Biosystematics: Commemorating 50 years of the International

Organization of Plant Biosystematists. TAXON 60 (2) • April 2011: 317–319
5.Nelson, G. and N. Platnick. 1981. Systematics and Biogeography: Cladistics and Vicariance. New York: Columbia University Press.
6.Mayr, E.1969. Principles of Systematic Zoology.Mc.Graw-Hill Book Company. New York. 428 hal
7.Mayr, E., 1974. Population, Species, and Evolution. The Belknap Press of Harvard University Press Cambridge, Massachusetts.
8.Mayr, E. and P.D.Ashlock, 1991. Principles of Systematic Zoology. Second Ediition. McGraw-Hill, New York: 475 pp.
9.Simpson, G.G. 1961.Principles of Animal Taxonomy. Columbia University Press, New York.
10.Sokal, R.R. and P.H.A.Sneath. 1963. The Principles of numerical taxonomy. W.H. Freeman and Co., San Fransisco, California.
11.Stace,C.A. 1989. Plant Taxonomy and Biosystematics. Publisher: Hodder Arnold; 2nd ed. 264 pages..
12.Stebbins, G.L. 1971. Processes of Organic Evolution. Prentice-Hall Inc. Englewood Cliffs, New Jersey.
13. Stuessy, T.F. 1989. The Systematic Evaluation of Comparative Data. John Wiley & Sons, New York.
14.Turesson, G.: 1922. 'The Species and the Variety as Ecological Units', Hereditas 3, 100–113.
15.Valentive, D.H and A. Love, 1958.Taxonomic and Biosystematic Category. Brittonia Vol. 10 No. 4 (Oct, 15, 1958). Pp 153-166.
16.Wiley, E.O., 1981.Phylogenetics: The theory and practice of phylogenetic systematic. John Wiley & Sons, New York. 439 pp

Addition:

1. Journal related to dissertation topic

Microbiological Analysis of Food

Course code	BIDB243052
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Sari Darmasiwi, S.Si., M. Biotech., Ph.D.
Lecture(s)	Sari Darmasiwi, S.Si., M. Biotech., Ph.D.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1. Upon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology CPL 4.1. fter participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction

Course Learning Outcome	BIDB243052.1 By the end of this course, students will be able to demonstrate good practices in food microbiology research, including standards, risks, and food safety BIDB243052.2 By the end of this course, students will be able to explain the types of spoilage, indicator, and pathogenic microorganisms in food BIDB243052.3 By the end of this course, students will be able to select appropriate methods for examining food materials and identify damage or diseases caused by microorganisms in food. BIDB243052.4. By the end of this course, students will be able to explain methods of controlling microorganisms in food
Course Description	This course explained the fundamentals of food microbiology laboratories, food safety, and associated risks. It examines microbial interactions with food materials, including indicator microorganisms and foodborne pathogens. Topics include sampling methods for microbiological analysis of food and processing environments; enumeration of specific microorganisms in food (bacteria and fungi); identification of food spoilage microorganisms; identification of foodborne pathogenic microorganisms (bacteria and fungi); determination of microbial activity; and methods for controlling foodborne microorganisms through physical, chemical, and biological approaches
Assessments	The assessment for Selected Topic for Dissertations (Microbiological Analysis of Food) is based on five components, with the respective criteria and weights: A. Participatory Activity (20%) B. Project result/Study case result/PBL Result (25%) C. Assignment (25%) D. Mid-term Exam (15%) E. Final-term Exam (15%)
Study Media and Literature	**Main:** 1. Yousef, A. E., Waite-Cusic, J. G., & Perry, J. J. (2022). Analytical food microbiology: A laboratory manual. John Wiley & Sons. 2. Torre, L. S., Aguilar, C. N., Kannan, P., & Haghi, A. K. (Eds.). (2022). Quantitative Methods and Analytical Techniques in Food Microbiology: Challenges and Health Implications. CRC Press. 3. Erkmen, O. (2021). Microbiological analysis of foods and food processing environments. Academic Press. **additional:** 4. Adam, M.R., M.O.Moss (eds). 2016. Food microbiology. 4th ed. The Royal Society of Chemistry, Cambridge.

5. Jay, J.M., M.J. Loessner, D.A. Golden. 2005. Modern food microbiology. 7thed. Springer, New York.
6. Ray, B. 2013. Fundamental food microbiology. 5th ed. CRC Press, Boca Raton.
7. Al Bulushi, I. M. (2017). The handbook of food microbiological analytical methods. Nova Science Publishers, Inc..

Etnobotany

Course code	BIDB203005
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Ratna Susandarini, M.Sc.
Lecture(s)	Prof. Dr. Ratna Susandarini, M.Sc. Prof. Rina Sri Kasiamdari S.Si., Ph.D Abdul Razaq Chasani, S.Si., M.Si., Ph.D..
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.3. Upon completing this program, the graduates demonstrate an attitude of being able to internalize academic values, norms and ethics CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.2. After completing this program, the graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology CPL 3.3. After completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism

Course Learning Outcome	BIDB203005.1 By the end of this course, students will be able to master the philosophy of Ethnobotany and its relevance to food, architecture, medicine, social and cultural practices, ethnoecology, and plant conservation. BIDB203005.2 By the end of this course, students will be able to to demonstrate understanding of the contributions of Biology, Agriculture, Pharmacy, Forestry, and History to ethnobotanical analysis. BIDB203005.3 By the end of this course, students will be able to determine appropriate methods of data collection and analysis in Ethnobotany according to research objectives. BIDB203005.4 By the end of this course, students will be able to plan and conduct ethnobotanical research through a multidisciplinary approach in accordance with scientific principles
Course Description	This course explores the cultural uses of organisms in traditional contexts, including their classification for food, construction, medicine, and social purposes. It examines the roles of experts in history, biology, ecology, genetics, biochemistry, agriculture, and forestry in ethnobotanical studies. The course also covers ethnobotanical field research methods and approaches to data analysis.
Assessments	The assessment for Selected Topic for Dissertations (Etnobotany) is based on six components, with the respective criteria and weights: 1. Participatory Activity (20%) 2. Project result/studi case result/PBL Result (30%) 3. Assignment (10%) 4. Quiz (5%) 5. Mid-term Exam (15%) 6. Final-term Exam (20%)
Study Media and Literature	**Main** 1. Gary J. Martin, 1995. Ethnobotany a manual method. Royal Botanic Garden, Kew, UK 2. C. M. Cotton, 1996. Ethnobotany: Principles and Applications. John Wiley and Sons, Ltd., Baffins Lane, Chichester, West Sussex, PO19 1UD, England **Additional** 1. Leslie Main Johnson & Eugene S. Hunn, 2010. Landscape Ethnoecology SBN: 9781845456139, Publication Date: 2010-

	02-01, P G Sharma, 2012. Text Book of Ethnobotany, ISBN-13 : 978-9381575208 2. José L. Martinez, Amner Muñoz-Acevedo, Mahendra Rai, 2019. Ethnobotany Application of Medicinal Plants 3. Ulysses Paulino de Albuquerque, Rômulo Romeu Nóbrega Alves, 2016. Introduction to Ethnobiology.Springer Nature

Applied Animal Physiology

Course code	BIDB243038
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr.biol.hom. Nastiti Wijayanti, S.Si., M.Si.
Lecture(s)	Dr.biol.hom. Nastiti Wijayanti, S.Si., M.Si. Dr. Slamet Widiyanto Dr. Fajar Sofyantoro
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1. After attending this program, graduates demonstrate an understanding of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems CPL 3.2. After completing this program, the graduates will be able to contribute to development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology CPL 4.3. After participating in this program, graduates will be able to Apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenerfy, biomaterial and/or the environment.

Course Learning Outcome	BIDB243038.1 By the end of this course, students will be able to recognize and critically appreciate the contributions of pioneering researchers in the field of Animal Physiology, with particular emphasis on its applied dimensions. BIDB243038.2 By the end of this course, students will be able to demonstrate professional and ethical responsibility to society regarding the impacts of scientific advancements in the field of Animal Physiology. BIDB243038.3 By the end of this course, students will be able to anticipate problems and devise appropriate solutions to issues related to Animal Physiology. BIDB243038.4 By the end of this course, students will be able to communicate and apply knowledge of Animal Physiology for the enhancement of animal and human well-being.
Course Description	This course begins with an exploration of fundamental principles in Animal Physiology and the concept of homeostasis. It then progresses to a more in-depth discussion of physiological phenomena through the application of contemporary methods and approaches. Topics covered include basic physiological mechanisms such as blood chemistry tests, pathophysiology, and the role of the microbiome in animal health and disease. The course also addresses applied areas such as stem cells, neuroscience, laboratory animal science, and hematology. In addition, students will be introduced to advanced techniques in animal physiology research, including genomics and proteomics, CRISPR technology, and molecular imaging techniques. Animal bioethics constitutes an integral component of the course. Through case-based learning and interactive discussions, students are expected to apply knowledge of animal physiology in both research and daily life, while also understanding the scientific and societal impacts of such research. The course is further enriched with experimental protocols and case studies designed to enhance students' comprehension of physiological mechanisms and their applications across diverse conditions and modern research domains. Students are also expected to effectively communicate and apply their knowledge to promote the well-being of both animals and humans.

Assessments	The assessment for Selected Topic for Dissertations (Applied Animal Physiology) is based on three components, with the respective criteria and weights: 1. Participatory Activity (30%) 2. Project Result/Study case result/PBL Result (30%) 3. Assignment (40%)
Study Media and Literature	**Main** 1. FELASA. 2008. Course in Laboratory Animal Science (FELASA Category-C Course). Federation of European Laboratory Animal Science Associations (FELASA). 2. Goodenough, J.E., B. McGuire, and R.A. Wallace. 1993. Perspective on Animal Behavior. John Wiley & Sons, Inc. Toronto. 3. OECD. 2000. OECD Guidelines for the Testing of Chemicals. Organisation for Economic Co-operation and Development (OECD). Paris. 4. Pinel, J.P.J. 2009. Biopsychology. Seventh Edition. Pearson Education Inc. Boston. 5. Price, S.A. dan L.M. Wilson. 2006. Patofisiologi: Konsep Klinis Proses-Proses Penyakit. Edisi 6. Cetakan I. Penerbit Buku Kedokteran EGC. Jakarta. **Additional** 1. van Tienhoven, A. 1983. Reproductive Physiology of Vertebrates. Second Edition. Comstock Publishing Associates. Cornell University Press. London. 2. Wilmore, J.H., D.L. Costill, and W. L. Kenney. 2008. Physiology of Sport and Exercise. Fourth Edition. Human Kinetics Publishers, Champaign.

Applied Palynology

Course code	BIDB203193
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Ratna Susandarini, M.Sc.
Lecture(s)	Prof. Dr. Ratna Susandarini, M.Sc. Prof. Dr. L. Hartanto Nugroho, M.Agr. Prof. Dr. Yekti Asih Purwestri, M.Si.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.2. After completing this program, the graduates will be able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner; CPL 2.1. After attending this program, graduates will be able to contribute to the development and practice of the field of biology through scientific research based on scientific principles and ethics through interdisciplinary, multidisciplinary, or transdisciplinary approaches in solving problems in the field of biology; CPL 2.3. After completing this program, the graduates will be able to manage and formulating valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism

	CPL 3.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL.4.3. After completing this program, the graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB203193.1 By the end of this course, students will be able to correctly apply the concepts and working principles of Plant Biosystematics and Experimental Systematics methods to reveal biodiversity through research at the doctoral level. BIDB203193.2 By the end of this course, students will be able to determine the types of data and appropriate data collection methods according to the research objectives of their dissertation within the scope of Plant Biosystematics.. BIDB203193.3 By the end of this course, students will be able to evelop or modify and innovate research methods to achieve the objectives of their dissertation research within the scope of Plant Biosystematics. BIDB203193.4 By the end of this course, students will be able to determine and perform appropriate data analysis methods and interpret the results to address research problems and achieve the objectives of their dissertation within the scope of Plant Biosystematics, including proficiency in using software tools for phenetic and phylogenetic analysis.
Course Description	This course covers topics related to Pollen Biology, Melissopalynology, Honey Phytochemistry, and Honey Biochemistry, with content tailored to the students' dissertation topics. The general topics include Pollen Characteristics, Applications of Palynology, Physicochemical Analysis of Pollen Products, Analysis of Primary and Secondary Metabolites in Pollen Products, Pollen and Nectar in Honey, Pollen Analysis in Honey, and Qualitative and Quantitative Methods of Pollen Analysis.

Assessments	The assessment for Selected Topic for Dissertation (Applied Palynology) is based on five components, with the respective criteria and weights: K. Assignment (10%) L. Presentation (10%) M. Mini Project (30%) N. Mid-term Exam (20%) O. Final-term Exam (30%)
Study Media and Literature	**Main:** • D'Albore GR. 2009. Textbook of Melissopalynology. Apimondia Publishing House • Hooper T. 2008. Guide to Bees & Honey. Northern Bee Book Publishing • McKenzie K. (Editor). 2023. The Illustrated Encyclopedia of Palynology. Callisto Reference • Niranjan D. 2017. Natural Products Chemistry. Write And Print Publications • Goncalves RE and Pinto MC (Editors), 2012. Natural Products: Structure, Bioactivity and Applications. Nova Science Publishers. **additional:** • Scientific journals on Palynology and Natural Peoducts • Pollen Databases

Experimental Systematics

Course code	BIDB203006
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. Ratna Susandarini, M.Sc.
Lecture(s)	Prof. Dr. Ratna Susandarini, M.Sc. Prof. Rina Sri Kasiamdari, Ph.D. Abdul Razaq Chasani, Ph.D.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.2. After completing this program, the graduates will be able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner; CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development; CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology; CPL 3.3. After completing this program, the graduates will be able to manage and formulate valid and accountable research data

	by upholding academic integrity and prioritizing anti-plagiarism; CPL.4.3. After completing this program, the graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB203006.1 By the end of this course, students will be able to accurately apply the concepts and working principles of Plant Biosystematics and Experimental Systematics methods in exploring biodiversity through research at the doctoral level. BIDB203006.2 By the end of this course, students will be able to determine the type of data and appropriate data collection methods in accordance with the objectives of a Dissertation research within the scope of Plant Biosystematics. BIDB203006.3 By the end of this course, students will be able to develop, modify, or innovate research methods to achieve the objectives of Dissertation research within the scope of Plant Biosystematics. BIDB203006.4 By the end of this course, students will be able to determine and apply appropriate data analysis methods and interpret the results to address research problems and achieve the objectives of Dissertation research within the scope of Plant Biosystematics, including proficiency in utilizing software for phenetic and phylogenetic analyses.
Course Description	This course covers the study of diversity, variation, and taxonomic relationships among plant taxa, with content tailored to the specific dissertation topics of the students. The course materials generally include: diversity and classification of taxa at the levels of family, genus, species, and intraspecific categories; phenotypic and genotypic variation at both inter- and intra-specific levels; morphological, anatomical, phytochemical, and molecular characterization; methods of data collection in plant systematics; and data analysis methods employing phenetic and phylogenetic approaches.

Assessments	The assessment for Selected Topic for Dissertation (Experimental Systematics) is based on five components, with the respective criteria and weights: P. Assignment (10%) Q. Presentation (10%) R. Mini Project (30%) S. Mid-term Exam (20%) T. Final-term Exam (30%)
Study Media and Literature	**Main:** • Mekonnen G, Dessalegn Y. 2012. Plant Taxonomy and Systematics: Concepts ,Sources, Botanical Nomenclature, Plant Collecting and Documentation, Herbaria and Data Information Systems. LAP Lambert Academic Publishing • Rana TS, Nair KN, Upreti DK. 2020. Plant Taxonomy and Biosystematics: Classical and Modern Methods. NIPA Publishing. • Judd WS, Campbell CS, Kellogg EA, Stevens PF, Donaghue MJ. 2016. Plant systematics: a phylogenetic approach. Fourth edition. Sinauer Assoc. Sunderland, MA. • Heywood VH,. Brummitt RK, Culham A, Seberg O. 2007. Flowering plant families of the world. Firefly Books. Buffalo, NY. **additional:** • Watson, L. & M. J. Dallwitz. 1997. The families of flowering plants: descriptions and illustrations. <http://muse.bio.cornell.edu/delta/angio/www/index .htm> • Scientific journals on Plant Taxonomy, Systematics, and Evolution (Journal of the Arnold Arboretum, Kew Bulletin, Plant Systematics and Evolution, Rhodora, Systematic Botany, Taxon, Watsonia).

Vascular Plant Comparative Anatomy

Course code	BIDB243067
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Dr. Maryani M.Sc.
Lecture(s)	Dr. Maryani M.Sc. Prof. Dr. L. Hartanto Nugroho M.Agr.
Language	Indonesian/English
Classification within the Curriculum	Compulsory Specialization Courses
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.2. After completing this program, the graduates will be able to demonstrate honesty, responsibility, self-confidence, emotional maturity, ethics, and awareness of being a lifelong learner; CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development; CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology; CPL 3.3. After completing this program, the graduates will be able to manage and formulate valid and accountable research data by upholding academic integrity and prioritizing anti-plagiarism;

	CPL.4.3. After completing this program, the graduates will be able to apply the philosophy of biological systems in developing biological concepts in the areas of food, health, bioenergy, biomaterial and/or the environment.
Course Learning Outcome	BIDB243067.1 By the end of this course, students will be able to accurately apply the concepts and working principles of Comparative Anatomy of Vascular Plants to investigate anatomical evolution from pteridophytes to angiosperms, anatomical adaptations of plants to their environments, and anatomical sample preparation in plants through doctoral-level research. BIDB243067.2 By the end of this course, students will be able to determine the types of data and appropriate data collection methods in accordance with the objectives of Dissertation research within the scope of Comparative Anatomy of Vascular Plants. BIDB243067.3 By the end of this course, students will be able to develop, modify, or innovate research methods to achieve the objectives of Dissertation research within the scope of Comparative Anatomy of Vascular Plants. BIDB243067.4 By the end of this course, students will be able to determine and apply appropriate data analysis methods and interpret the results to address research problems and achieve the objectives of Dissertation research within the scope of Comparative Anatomy of Vascular Plants, including proficiency in the use of software for anatomical analyses at various levels of plant evaluation.
Course Description	This course focuses on the preparation of anatomical samples of plant organs, the study of vascular plant organ anatomy across evolutionary levels from pteridophytes to angiosperms, and the anatomical adaptations of vascular plants to their respective environments. Through these topics, students will gain a comprehensive understanding of structural diversity, evolutionary trends, and adaptive strategies in plant anatomy

Assessments	The assessment for Selected Topic for Dissertation (Vascular Plant Comparative Anatomy) is based on four components, with the respective criteria and weights: A. Assignment (20%) B. Presentation (20%) C. Mid-term Exam (30%) D. Final-term Exam (30%)
Study Media and Literature	**Main:** 1. Beck, C.B. 2010; An intruduction to plant strucutr and development. Cambridge University Press. Cambridge 2. Vashishta, P.C., A. K. Sinha, & A. Kumar. 2006. Botany for degree students : Gymnosperms. S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi 3. Cutter, E.G., 1970. Plant Anatomy: Experiment and interpretation. Part I: Cell and Tissues. Addison Wesley Publ. Co. Ontario. **additional:** 1. Eames, A.J. and L. H. MacDaniel. 1981. An introduction to plant anatomy. TMH Edit. Tata McGrow-Hill Publ. Comp. Ltd. Bombay 2. Esau, K., 1965, Plant Anatomy, 2nd edition, Wiley Eastern Private United, New Delhi. 3. Esau, K., 1979, Anatomy of seed plants, Wiley Eastern LTD. 4. Fahn, A., 1990, Plant anatomy, 4th edition, Pergamon Press. 5. Maherwari, P., 1955, An introdduction to the embryology of angiosperms. 1st edition, Mc Grow-Hill Book Co.Inc. New York. 6. Pandey, B.P.,1982, Plant anatomy, 3rd edition, S. Chan and Company Ltd. New York

Applied Genetic Engineering

Course code	BIDB203003
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Ganies Riza Aristya, S.Si., M.Sc., Ph.D.
Lecture(s)	Ganies Riza Aristya, S.Si., M.Sc., Ph.D. Arief Muammar, S.Si., M.Biotech., Ph.D.cand. Afif Pranaya Jati, S.Si., M.Sc., Ph.D.cand. Dr. Niken Satuti Nur Handayani, M.Sc
Language	Indonesian/English
Classification within the Curriculum	Compulsory
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	1,125 hours/day 5 days/week 5,625 hours/week 16 Weeks/Semester total workload : 90 hours/3,6 ECTS
Credits	3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 2.1.Upon completing this program, the graduates demonstrate an understanding of of the scientific philosophy of biology which is related in depth to structure, function, diversity, reproduction, evolution and engineering of biological systems. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology
Course Learning Outcome	BIDB203125.1 By the end of this course, students will be able to explain the development of molecular systematics, analyze controversies in molecular systematics, and

	discuss the applications and prospects of molecular systematics. BIDB203125.2 By the end of this course, students will be able to design research and molecular techniques used in molecular systematics studies, explain species identification methods using DNA barcode and metabarcode, perform intra- and interspecific differentiation analyses (using genetic distance and evolutionary models), and construct phylogenetic trees based on Neighbour Joining (NJ), Maximum Likelihood (ML), and Bayesian Inference (BI) methods.. BIDB203125.3 By the end of this course, students will be able to use and compare free software for data analysis in molecular systematics.
Course Description	This course is delivered through blended learning and covers a collaborative range of topics, including the development and controversies in molecular systematics; applications and prospects of molecular systematics; research design and molecular techniques used in molecular systematics studies; species identification using DNA barcode and metabarcode methods; intra- and interspecific differentiation (genetic distance methods and evolutionary models); phylogenetic tree construction methods; and the use of free software in molecular systematics. The primary learning objective of this course is to provide knowledge of molecular systematics and skills in using software for data analysis.
Assessments	The assessment for Selected Topic for Dissertations (Molecular Systematic) is based on Project Component, with the respective criteria and weights: 1. Stuctured Assigment/Task (50%) 2. Project Result/Case Study/Project Based Learning result (50%)
Study Media and Literature	1. DeSalle, R., Giribet, G., Wheeler, W. 2013. Molecular Systematics and Evolution: Theory and Practice. Birkhäuser Ltd. 2. Stewart, C. 2014. Comparative DNA Sequencing as a Tool of Molecular Systematics Koros Press Ltd

Aquatic Ecology

Course code	BIDB243029
Course level	Doctoral Program
Semester/ term	Odd/even
Course coordinator	Prof. Dr. rer. nat. Andhika Puspito Nugroho
Lecture(s)	Prof. Dr. rer. nat. Andhika Puspito Nugroho Siti Nurleily Marliana, Ph.D. Mukhlish Jamal Musa Holle, D.Phil.
Language	Indonesian/English
Classification within the Curriculum	Compulsory (Selected Topic For Dissertations)
Teaching format/ class hours per week during the semester	This course is planned to have 14 teaching weeks and 2 weeks of examination.
Workload	90 hours
Credits	2-0 credits / 3.6 ECTS
Requirements	-
Program Learning Outcome	CPL 1.1.pon completing this program, the graduates demonstrate an attitude of being able to contribute to improving the quality of life in society, nation and state, and the progress of civilization based on Pancasila. CPL 2.2. After attending this program, graduates demonstrate an understanding of substantial and leading theory in the field of biology/biological resources in order to support education for sustainable development CPL 3.1. After completing this program, the graduates will be able to discover or develop new scientific theories/concepts/ideas in biology CPL 4.2. After participating in this program, graduates will be able to propose new solutions or recommend proposed solutions to solve biological resource problems in a sustainable manner through an interdisciplinary or multidisciplinary approach to fund deduction or induction.
Course Learning Outcome	BIDB243029.1 By the end of this course, students will understand the fundamental concepts of aquatic ecology,

	encompassing both inland waters and marine ecosystems. BIDB243029.2 By the end of this course, students will be able to analyze and synthesize sampling techniques and data analysis methods in aquatic ecology research, particularly in relation to dissertation studies. BIDB243029.3 By the end of this course, students will be able to analyze theoretical and practical gaps in aquatic ecology research, particularly in relation to their dissertation studies BIDB243029.4 By the end of this course, students will be able to manage, lead, and develop research in the field of aquatic ecology. BIDB243029.5 By the end of this course, students will be able to solve problems in the field of aquatic ecology through inter- and multidisciplinary approaches.
Course Description	This course is designed to provide an in-depth understanding of both inland and marine aquatic ecosystems. It covers both fundamental and advanced principles, including the physical and chemical properties of water, water movement within ecosystems, energy flow, organismal adaptations particularly through traits-based approaches and functional diversity and the ecology of key aquatic ecosystem components (plankton, benthos, and nekton) across various aquatic ecosystem types. The course also explores ecological connectivity among different types of aquatic ecosystems. Contemporary issues and debates in aquatic ecology are also discussed. By the end of the course, students will analyze various sampling techniques and data analysis methods relevant to aquatic ecology, with the goal of refining their research methodologies for dissertation work. Furthermore, students will be challenged to develop and present a research proposal or case study, thereby strengthening the methodological and analytical skills necessary for conducting independent research and contributing scientifically to the field of aquatic ecology.

Assessments	The assessment for Selected Topic for Dissertations (Aquatic Ecology) is based on five components, with the respective criteria and weights: 1. Mid-term Exam (20%) 2. Final-term Exam (20%) 3. PBL 1 (20%) 4. PBL 2 (20%) 5. PBL 3 (20%)
Study Media and Literature	**Main** 1. Sommer, U. 2023. Freshwater and Marine Ecology. Springer. 2. Dobson, M., & Frid, C. 2008. Ecology of aquatic systems. Oxford University Press. **Additional** 3. Jones, I., J.P. Smol and R.G. Wetzel. 2023. Limnology: lake and river ecosystems 3rd edition. Academic Press. 4. Dodds, W. K. and M.T. Whiles. 2019. Freshwater ecology: concepts and environmental applications of Limnology 3rd edition. Elsevier. 5. Cole, G.A. and P. E. Weihe. 2015. Textbook of limnology. Waveland Press. 6. Bertness, M.D., Bruno, J.F., Silliman, B.R. and Stachowicz, J.J. eds., 2014. Marine community ecology and conservation. Sinauer Associates, Incorporated. 7. Levinton, J.S. 2021. Marine Biology: Function, Biodiversity, Ecology 6th edition. Oxford University Press.

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