Module Handbook:

Course Structure and Curriculum
for Doctoral Program of Environmental Science
By Course Pathway – 2017 Curricula

School of Postgraduate Studies
Diponegoro University

2022

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at the School of Postgraduate Studies, Diponegoro University

2017

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1. Introduction

1.1. About the Study Program

Carry out development that does not damage the environment and concern about the next generation have actually mandated by the State Policy Guidelines Republic of Indonesia in 1973. However, at implementation level, the implementation of development is a more focused aspect on economic growth and ignore the environmental as well as social aspects. This resulted in the depletion of natural resources, biodiversity, increasing pollution and environmental damage that trigger the environmental disasters such as floods, landslides and drought. Meanwhile, the various effects caused by global warming and climate change threat human life. In the era of globalization, free trade and regional autonomy, environmental aspects become central issues, in addition to the issue of depletion of energy reserves and declining water quality and quantity.

To respond the above issues, education that is able to instil knowledge, ethics and discovered a new theory in environmental management is necessary. Doctoral Program of Environmental Science (PDIL) Undip stands with license letter from Director General of Higher Education 2782/D/T/2008 and pioneered by the Manager and Lecturer of Master Program of Environmental Science Diponegoro University, is facilitated to achieve that goal. Doctoral Program of Environmental Science establishment is in line with the vision towards the Research University.

1.2. Accreditation

Doctoral Program of Environmental Science had been accredited by Badan Akreditasi Nasional Perguruan Tinggi (National Accreditation Board for Higher Education) of Republic of Indonesia, ISO, and still in processed by ASIIN.

1.3. Key Member of Staff

Doctoral Program

2. Tittle, Affiliation, and Language

2.1. Title

Doctoral Program of Environmental Science leads to a Doctor in Environmental Science with the Indonesian title: Dr (*Doctor*).

2.2. Affiliation

Since 2006, this program becomes member of SEE (Sustainable Energy and Environment) Forum. SEE Forum is Asia Pacific Academic and Science and Technological Forum that brings forward dialogue on global climate and energy security issues.

2.3. Language

The programme is conducted in Indonesian, but could also provide English-based learning, projects, theses, and etc by the request from international students.

3. Academic Profile

3.1. Objective

The graduates of Doctoral Program of Environmental Science are expected to have capabilities in: (a) developing concept of science and technology in the field of environmental through research; (b) managing, leading, and developing a research program; (c) developing professional performance with interdisciplinary approach.

3.2. General Structure of the Programme

Doctoral Program of Environmental Science is set at 47 credits (Sistem Kredit Semester/ SKS) or equivalent to 174 ECTS.

Doctoral Program consists of the following elements:

- Matriculation courses (No Credits).
- Compulsory courses (Credits: 43 SKS/ 162 ECTS), including the dissertation, research supervisory courses, and examination.
- Elective courses (Credits: 4 SKS/ 12 ECTS, but the study program is offering 7 courses weighted 2 SKS/ 6 ECTS for each course).

Doctoral Program of Environmental Science set the maximum study period is seven years or fourteen semesters, whereas the student could be dropped out.

3.3. Career Opportunities

Doctoral Program of Environmental Science qualifies students to become professionals within business, management, and research functions and/or areas such as:

- Academia as a Lecturer within universities.
- Researcher in any research institutions, varying from government's research body to the think tank institution.
- As a leading innovator and researcher in industries in improving environmentally sustainable product processes, promoting circular business, improving waste management, developing breakthrough solution and remediation technologies in achieving better environmental condition.
- As a consultant and/ or advisor in national or international level with strong basis in environmental management and environmental protection.
- Public administration in municipalities working in environmental monitoring, assessment, and protecting local's region from any environmentally unsustainable land utilization.
- Policy maker and advocate working in policy assessment and development in promoting the value of sustainable development within the government (national and local), private organization, or international NGOs.

4. Description of Learning Outcome

The learning outcome from the academic structure in Doctoral Program of Environmental Science through By Course pathway are as follows:

- Able to analyze, develop and apply the conceptual and theoretical thinking of environmental science in various environmental research.
- Able to parse theoretical abstractions in environmental science and its application through mastery of environmental management concepts along with rules and policies.
- Able to carry out stages in the environmental research process through problem identification, risk analysis, management concept, alternative solution, data analysis, conclusion and recommendation that are functional and efficient.
- Able to demonstrate scientific attitude and think critically in carrying out duties professionally through appreciation of religion, culture, humanity, morals and ethics.

5. Admission Requirements

5.1. Education Requirements

Doctoral Program on Environmental Science is a multi-entry program. Entering the program, candidates should have graduated in any disciplines with:

- Holding a master's degree from any disciplines.
- Prior degree must be gained from B accredited universities (overseas graduates, diplomas must be equalized by the Directorate General of Higher Education).
- Minimum GPA of 3.00/4.00.
- Have working experiences in environment-related field would be a plus.

5.2. Language Requirements

There are no minimum language requirements to enrol to this program.

5.3. Supplementary Document Requirements

Prospective students must prepare the following documents:

- Academic recommendation from Professor/Doctor (min. 2).
- Letter of guarantee for tuition fees.
- Synopsis of research proposals max. 5 pages.

5.4. Admission Batch

Prospective students could enrol into two batch of admission per year. The first batch is for the prospective student who is preferring to enrol in the Odd Semester (July), whilst the second batch is for those who prefer to start their academic journey in the Even Semester (February).

5.5. Admission System

Detailed admission schedule, timeline, and submission system could be accessed through Diponegoro University's admission website.

- For national prospective students: https://pmb.undip.ac.id/
- For international prospective students: https://pmb.undip.ac.id/international/graduate-program/

5.6. Tuition Fee

Prospective students are required to pay the tuition fee which shall be paid early at every semester. The amount might be differed from year to year. For the updated information, prospective students could access the information through this link: http://dil.pasca.undip.ac.id/tuition-fee-2/

5.7. Scholarship

Diponegoro University provides a Master to Doctorate scholarship program which open every year. The updated information could be accessed through Institute for Research and Community Service's website. The opening for the 2020 batch information could be accessed through this link: https://lppm.undip.ac.id/2020/01/13/pengumuman-penerima-program-pendidikan-magister-doktor-menuju-sarjana-unggul-universitas-diponegoro-pmdsu-undip-tahun-2020/

6. Graduation Requirements

To be qualified to be honoured the Doctoral Degree from Doctoral Program of Environmental Science, students must be fulfilled the publication and language requirements.

6.1. Publication Requirements

Complying with the Indonesian Government Regulation, the students must be able to publish at least three publications before being qualified to be promoted as a Doctor of Environmental Science, with the detail as follows:

- One academic article published as a conference proceeding from an international conference.
- One academic article published in a national reputable journal.
- One academic article published in an international reputable journal.

6.2. Language for Graduation Requirements

To be able to graduate, students must be able to achieve language proficiency test with a minimum score of 500 for TOEFL ITP test or equivalent to 5.5 for IELTS test.

Structure of the Programme

6.3. Matriculation

Due to various background of new students, it is required to have matriculation knowledge to give basic understanding of environment. Thus, Doctoral Program of Environmental Science is offering the Matriculation Course in the beginning of the semester. The subjects that would be taught in this course are as follows:

No	Code	Courses	Credits	
			SKS	ECTS
1	-	Basic Understanding of Ecology	NC	NC
2	-	Human Ecology	NC	NC
3	-	Industrial Ecology	NC	NC
4	-	Spatial and Environmental Dimensions	NC	NC
5	-	Dimensions of Pollution and Environmental Damage	NC	NC
Total			**NC: No Credits**	

6.4. Compulsory Courses

By Course pathway in Doctoral Program of Environmental Science offers compulsory courses as follows:

No	Code	Course	Credits	
			SKS	ECTS
1	C IL 2 3 811	Philosophy of Science and Research Methodology	3	9
2	C IL 2 3 812	Ecology and Global Environmental Change	3	9
3	C IL 2 3 813	System Analysis and Environmental Modelling	3	9
4	C IL 2 3 828	Scientific Articles Writing	3	6
5	C IL 2 3 829	Proposal Writing	3	15
6	C IL 2 3 834	Research 1 and Seminar of Result Phase 1	4	18
7	C IL 2 3 836	Scientific Publications 1	2	12
8	C IL 2 3 842	Research 2 dan Seminar of Result Phase 2	3	18
9	C IL 2 3 843	Scientific Publications 2	3	12
10	C IL 2 3 851	Research 3 dan Seminar of Result Phase 3	3	12
11	C IL 2 3 852	Dissertation Feasibility Examination	2	6
12	C IL 2 3 853	Scientific Publications 3	3	12
13	C IL 2 3 861	Dissertation Defence	5	12
14	C IL 2 3 862	Doctoral Promotion	3	12
Total credits			**43**	**162**

The detail of each course would be described in the following sub sections:

6.4.1. Philosophy of Science and Research Methodology

Module designation	Philosophy of Science and Research Methodology
Module level, if applicable	-
Code, if applicable	C IL 2 3 811
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	1st Semester
Person responsible for the module	Prof. Sudharto Prawata Hadi, MES, Ph.D.
Lecturer	1. Prof. Sudharto Prawata Hadi, MES, Ph.D. 2. Prof. Dr. Ir. Purwanto, DEA 3. Dr. Dra. Henna Rya Abdurachim, Apt., MES
Language	*Indonesian and English*
Relation to curriculum	Students are able to understand the position of knowledge, study of knowledge and scientific perspectives and philosophy of science through lectures and discussion activities
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes). • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (96 hours, 6 hours weekly for 16 weeks). • Peer group discussion (24 hours, 1.5 hour weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (17.6 hours, 1.1 hours weekly for 16 weeks). Total contact hours in 1 semester = 225 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (4.44 hours) • Independent work (reading books, materials, papers, literature review, etc. : 5.33 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 10.67 hours)

	• Peer group discussion (2.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (1.89 hours) Total workload for one ECTS = 25 hours
Laboratory work	This course requires no laboratory work
Credit points	3 SKS which equivalent to 9 ECTS
Requirements according to the examination regulations	Minimum attendance of lectures 75%
Recommended prerequisites	-
Module objectives/ intendedlearning outcomes	• Have the ability to explore, integrate, and construct varioussources of knowledge in the reality of life into the scope of science. • Have the ability to select and build linkages between the uniqueness of various local knowledge for scientific development according to the rules of science. • Able to describe the relationship between knowledge, philosophy and philosophy of science from sociology, epistemology, and axiology.
Content	• The Philosophy of Science course discusses • The position of knowledge, habits, beliefs of a person or group of people in science, knowledge of sources of knowledge, scientific methods, scientific results, scientific attitudes, sources of truth and limitations of science • The role of science and technology in the development of human civilization • This course trains students to think logically, critically, comprehensively, and contemplatively • Understand the interrelationship between various sources of knowledge in the past with the present and the future in the development of science and technology • The integration of axiological anatraontology in building artifacts as scientific products.
Reading Materials	Amaratunga, D., Baldry, D., Sarshar, M., & Newton, R. (2002). Quantitative and Qualitative Research in the Built Environment: Application of "Mixed" Research Approach. Work Study. Howell, K. E. (2012). An Introduction to the Philosophy of Methodology. Sage. Kothari, C. R. (2004). Research Methodology: Methods and Techniques. New Age International.

	Snyder, H. (2019). Literature Review as a Research Methodology: An Overview and Guidelines. Journal of Business Research, 104, 333-339.

6.4.2. Ecology and Global Environmental Change

Module designation	Ecology and Global Environmental Change
Module level, if applicable	-
Code, if applicable	C IL 2 3 812
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	1st Semester
Person responsible for the module	Prof. Dra. Norma Afiati, M.Sc., Ph.D.
Lecturer	1. Prof. Dra. Norma Afiati, M.Sc., Ph.D. 2. Prof. Ir. Didi Dwi Anggoro, M.Eng., Ph.D. 3. Dr. Ir. Hermawan, DEA.
Language	Indonesian and English
Relation to curriculum	-
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes). • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (96 hours, 6 hours weekly for 16 weeks). • Peer group discussion (24 hours, 1.5 hour weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (17.6 hours, 1.1 hours weekly for 16 weeks). Total contact hours in 1 semester = 225 hours
Student Workload for One ECTS	• Face-to-face lecturers in class (4.44 hours) • Independent work (reading books, materials, papers, literature review, etc. : 5.33) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 10.67 hours) • Peer group discussion (2.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (1.89 hours) • Total workload for one ECTS = 25 hours
Laboratory Work	This course requires no laboratory work

Credit points	3 SKS which equivalent to 9 ECTS
Requirements according to the examination regulations	Minimum attendance of lectures 75%
Recommended prerequisites	-
Module objectives/intended learning outcomes	• Able to describe the history of ecological development • Able to describe the interrelationships of living things andtheir environment • Able to describe important basic concepts in an ecosystem.
Content	• The Ecology and Global Environmental Change course is a compulsory subject in the Environmental Science Doctoral study program • Explanation of the history and ecological approach • The concept of environmental factors and their effects on living things • Habitats and niches • Responses and adaptations, • Populations, communities, ecosystems and global environmental changes.
Study and examination requirements and forms ofexamination	• Open book and close book • Multiple choice, case study, interview, practice
Media employed	Power point, YouTube, website
Reading materials	Adger, W. N., Benjaminsen, T. A., Brown, K., & Svarstad, H. (2001). Advancing a Political Ecology of Global Environmental Discourses. Development and Change, 32(4), 681-715. Buechler, S., & Hanson, A. M. S. (Eds.). (2015). A Political Ecology of Women, Water and Global Environmental Change (p. 99). New York: Routledge. Jasanoff, S. (2018). 8. Science and Norms in Global Environmental Regimes. In Earthly goods (pp. 173-197). Cornell University Press. Kasperson, J. X., Kasperson, R. E., Turner, B. L., Hsieh, W., & Schiller, A. (2022). Vulnerability to Global Environmental Change. In the Social Contours of Risk (pp. 245-285). Routledge.

6.4.3. System Analysis and Environmental Modelling

Module designation	System Analysis and Environmental Modelling
Module level, if applicable	
Code, if applicable	C IL 2 3 813
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which the module is taught	1st Semester
Person responsible for the module	Prof. Dr. Ir. Purwanto, DEA
Lecturer	1. Prof. Dr. Ir. Purwanto, DEA 2. Prof. Dr. Sutrisno Anggoro, M.S.
Language	*Indonesian and English*
Relation to curriculum	Compulsory
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes). • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (96 hours, 6 hours weekly for 16 weeks). • Peer group discussion (24 hours, 1.5 hour weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (17.6 hours, 1.1 hours weekly for 16 weeks). Total contact hours in 1 semester = 225 hours
Student Workload for One ECTS	• Face-to-face lecturers in class (4.44 hours) • Independent work (reading books, materials, papers, literature review, etc : 5.33 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 10.67 hours) • Peer group discussion (2.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (1.89 hours) Total workload for one ECTS = 25 hours
Laboratory Work	This course requires no laboratory work

Credit points	3 SKS which equivalent to 9 ECTS
Requirements according to the examination regulations	*Minimum attendance of lectures 75%*
Recommended prerequisites	-
Module objectives/intended learning outcomes	• *Able to identify, formulate and analyze complex engineering problems on integrated systems based on analytical, computational or experimental approaches.* • *Mastering the principles and techniques of integrated system design with an environmental systems approach.* • *Able to research and investigate complex engineering problems on integrated systems using basic engineering principles and by carrying out research, analysis, data interpretation and information synthesis to provide solutions.*
Content	• This course studies systems and system modeling, especially systems in the environment • This course studies the process/steps of mathematical modeling for problems in environmental systems • The process of model verification and validation, to finding solutions or model analysis.
Study and examination requirements and forms ofexamination	• *Open book and close book* • *Multiple choice, case study, interview, practice*
Media employed	*Power point, YouTube, website*
Reading Materials	Lee, G. Y., Hickie, I. B., Occhipinti, J. A., Song, Y. J. C., Skinner, A., Camacho, S., ... & Freebairn, L. (2022). Presenting a Comprehensive Multi-Scale Evaluation Framework for Participatory Modelling Programs: A Scoping Review. PloS one, 17(4), e0266125. Rahmati, O., Kornejady, A., Samadi, M., Deo, R. C., Conoscenti, C., Lombardo, L., ... & Bui, D. T. (2019). PMT: New Analytical Framework for Automated Evaluation of Geo-Environmental Modelling Approaches. Science of the Total Environment, 664, 296-311. Refsgaard, J. C., van der Sluijs, J. P., Højberg, A. L., & Vanrolleghem, P. A. (2007). Uncertainty in the Environmental Modelling Process–a Framework and Guidance. Environmental Modelling & Software, 22(11), 1543-1556. Skidmore, A. (2017). Environmental Modelling with GIS and Remote Sensing. CRC Press.

6.4.4. Scientific Articles Writing

Module designation	Scientific Articles Writing
Module level, if applicable	-
Code, if applicable	C IL 2 3 828
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	2nd
Person responsible for the module	Prof. Dr. Ir. Hadiyanto, S.T., M.Sc., IPU
Lecturer	1. Prof. Dr. Ir. Hadiyanto, S.T., M.Sc., IPU 2. Prof. Dr. Istadi, S.T., M.T.
Language	*Indonesian and English*
Relation to curriculum	*Compulsory*
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes). • Independent work on reading materials and literature review (46 hours, 2.875 hours weekly for 16 weeks). • Writing manuscript draft (64 hours, 4 hours weekly for 16 weeks). Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face lectures in class (6.67 hours) • Independent work (reading books, papers, literature review) and structured assignments (7.67 hours) • Independent work on developing manuscript draft (introduction, research method, research framework, data analysis techniques, etc.: 10.67 hours) Total workload for one ECTS: 25 hours
Laboratory Work	This course requires no laboratory work
Credit points	3 SKS which equivalent to 6 ECTS
Requirements according to the examination regulations	Minimum attendance of lectures 75%

Required and recommended prerequisites for joining the module	The students have taken and passed the philosophy of science and research methodology course
Module objectives/intended learning outcomes	• Able to understand systematic guidelines for writing scientific articles • Able to compile scientific articles
Content	• Analysis of research topics, • Data processing techniques using origin software, compilation of bibliography and citations using mendeley software • software introduction to check the level of plagiarism.
Exams and assessment formats	Minimum attendance of lectures 75%
Study and examination requirements	The final grade in the module consists of 50% of scientific article draft and 50% of in-depth interviews
Reading list	Badley, G. F. (2022). Common—Reading—Placing—Writing. Qualitative Inquiry, 10778004221077711. Baird, A. (2021). On Writing Research Articles Well: A Guide for Writing IS Papers. Journal of the Association for Information Systems, 22(5), 1197-1211. Cargill, M., & O'Connor, P. (2021). Writing Scientific Research Articles: Strategy and Steps. John Wiley & Sons. Hailman J.P., Strier K.B, 2006. Planning, Proposing, and Presenting Science Effectively, 2nd Edition. Cambridge University Press. Cambridge. McMillan V.E. 2001. Writing papers in the Biological Sciences. Bedford/St. Martins. New York.

6.4.5. Proposal Writing

Module designation	Proposal Writing
Module level, if applicable	-
Code, if applicable	C IL 2 3 829
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	2nd
Person responsible for the module	Principal Supervisor
Lecturer	Principal Supervisor and Co Supervisor
Language	*Indonesian and English*
Relation to curriculum	Compulsory
Type of teaching, contact hours	• Discussion with Principal Supervisor (32 hours, 2 hours weekly for 16 weeks). • Discussion with Co Supervisor (32 hours, 2 hours weekly for 16 weeks). • Independent work on reading materials and literature review (144 hours, 9 hours weekly for 16 weeks). • Independent work on writing manuscript draft (135 hours, 8.4375 hours weekly for 16 weeks). • Preparing progress report (32 hours, 2 hours weekly for 16 weeks). Total hours in 1 semester = 375 hours
Student Wrokload for One ECTS	• Face-to-face discussion with Principal Supervisor (1.07 hours) • Face-to-face discussion with Co-Supervisor (1.07 hours) • Independent work (reading books, materials, papers, literature, etc. : 9.6 hours) • Writing proposal draft (introduction, research method, research framework, data analysis techniques, etc.: 10.67 hours) • Writing progress report (improvement, evaluation, constraints, etc.: 2.6 hours) Total workload for one ECTS: 25 hours
Laboratory Work	This course requires no laboratory work
Credit points	3 SKS which equivalent to 15 ECTS

Requirements according to the examination regulations	The principal supervisor and co-supervisor have approved the research proposal
Required and recommended prerequisites for joining the module	The students have taken and passed the philosophy of science and research methodology course
Module objectives/intended learning outcomes	• Able to compose a complete research proposal in accordance with thesis guidelines • Able to present a thesis proposal in the form of a seminar
Content	• Mentoring about literature study, research topic selection, and research title • Discussion and mentoring about research background, research questions, and research objectives. • Discussion about state of the art and novelty • Discussion and mentoring about research design, research framework, and research methods.
Exams and assessment formats	Seminar and in-depth interview
Study and examination requirements	The final grade in the module consists of 80% in-depth interviews, 20% participation in monitoring and evaluating the progress report of the dissertation proposal. Students are required to submit a portfolio of progress reports and a dissertation draft according to the targeted stages to their respective supervisors.
Reading list	Agus Salim. (2006). Teori dan Paradigma Penelitian Sosial. Yogyakarta: Tiara Wacana. Bloomberg, L. D., & Volpe, M. (2018). Completing your Qualitative Dissertation: A Road Map from Beginning to End. Joyner, R. L., Rouse, W. A., & Glatthorn, A. A. (2018). Writing the Winning Thesis or Dissertation: A Step-by-Step Guide. Corwin press. Perry, J. A., Zambo, D., & Crow, R. (2020). The improvement Science Dissertation in Practice: A Guide for Faculty, Committee Members, and their Students. Myers Education Press. Sugiyono. (2007). Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R & D. Bandung: ALFABETA

6.4.6. Research 1 and Seminar of Result Phase 1

Module designation	Research 1 and Seminar of Result Phase 1
Code, if applicable	C IL 2 3 834
Semester(s) in which the module is taught	3rd
Person responsible for the module	Head of Study Program; Principal Supervisor & Co Supervisor
Language	*Indonesian and English*
Relation to curriculum	*Compulsory*
Teaching methods	*Progress Report, Presentation, Discussion.*
Type of teaching, contact hours	• Discussion with Principal Supervisor (32 hours, 2 hours weekly for 16 weeks). • Discussion with Co-Supervisor (32 hours, 2 hours weekly for 16 weeks). • Independent work on reading materials and literature review (±130 hours, 8.1 hours weekly for 16 weeks) • Developing research proposal (160 hours, 10 hours weekly for 16 weeks). • Preparing progress report (32 hours, 2 hours weekly for 16 weeks). • Preparing presentation materials (32 hours, 2 hours weekly for 16 weeks). • Preparing manuscript and conference (32 hours, 2 hours weekly for 16 weeks). Total hours in 1 semester = 450 hours
Student Workload for One ECTS	• Face-to-face discussion with Principal Supervisor (1.78 hours) • Face-to-face discussion with Co-Supervisor (1.78 hours) • Independent work (reading books, materials, papers, literature review, etc. : 7.22 hours) • Developing proposal draft (introduction, research method, research framework, data analysis techniques, etc.: 8.89 hours) • Preparing progress report (improvements, challenges, constraints, etc.: 1.78 hours) • Preparing presentation materials for discussion with supervisors (1.78 hours) • Preparing manuscript and conference (1.78 hours) Total workload for one ECTS : 25 hours

Laboratory Work	Students taking this course have the chance to utilize the laboratory within the Diponegoro University according to each student's research needs
Credit points	*4 SKS which equivalent to 18 ECTS*
Requirements according to the examination regulations	Participate in monitoring and evaluating progress of the preparation of the dissertation organized by the Study Program; Collecting of portfolio of progress report for dissertation.
Required and recommended prerequisites for joining the module	Existing competencies in literature review and scientific writing.
Module objectives/intended learning outcomes	• Able to compile research plan. • Able to compile proposal dissertation.
Content	• Concepts of Abiotic, • Biotic and Culture at dissertation research in the field of environmental science; • Problem statements in dissertation research; • Formulation of objectives; • Formulation of research hypotheses; • Literature Review; • Originality of dissertation research; • State of the art and novelty; • Research methodology in dissertation research; • Objects and variables of dissertation research; • Portfolio of progress reports of the dissertation proposal..
Exams and assessment formats	*Mid-semester progress report assessment, final progress report assessment.*
Study and examination requirements	*The final grade in the module is composed of 80% performance on portfolio of progress reports, 20% participation in monitoring and evaluating. Students must submit a portfolio of progress reports and a draft dissertation according to the targeted stages as a minimum achievement to pass.*

Reading list	Modul of Writing Dissertation DES Kasperson, J. X., Kasperson, R. E., Turner, B. L., Hsieh, W., & Schiller, A. (2022). Vulnerability to Global Environmental Change. In the Social Contours of Risk (pp. 245-285). Routledge. Louv, R., & Fitzpatrick, J. W. (2012). Citizen Science: Public Participation in Environmental Research. Cornell University Press. Pohl, C. (2005). Transdisciplinary Collaboration in Environmental Research. Futures, 37(10), 1159-1178. Svarstad, H., Petersen, L. K., Rothman, D., Siepel, H., & Wätzold, F. (2008). Discursive Biases of the Environmental Research framework DPSIR. Land use policy, 25(1), 116-125.

6.4.7. Scientific Publication 1

Module designation	Scientific Publication 1
Code, if applicable	C IL 2 3 836
Semester(s) in which the module is taught	3rd
Person responsible for the module	Head of Study Program; Principal Supervisor & Co Supervisor
Language	Indonesian and English
Relation to curriculum	Compulsory
Type of teaching, contact hours	• Discussion with Principal Supervisor (32 hours, 2 hours weekly for 16 weeks). • Discussion with Co Supervisor (32 hours, 2 hours weekly for 16 weeks). • Preparing manuscript (152 hours, 9.5 hours weekly for 16 weeks). • Preparing presentation materials (48 hours, 3 hours weekly for 16 weeks). • Finding suitable conference (36 hours, 2.3 hours weekly for 16 weeks). Total hours in 1 semester = 300 hours
Student Workload for One ECTS	• Face-to-face discussion with Principal Supervisor (2.67 hours) • Face-to-face discussion with Co-Supervisor (2.67 hours) • Writing manuscript from zero to camera ready version (13.33 hours) • Preparing presentation materials for discussion with supervisors (2.67 hours) • Finding suitable conference (international level, proceeding selection, etc.: 3.67 hours) Total workload for one ECTS : 25 hours
Laboratory Work	There is no required laboratory work for this course. On the other hand, student taking this course might utilize the Diponegoro University's Library, Manuscript Consultation Center from LPPM, and the School of Postgraduate Studies' Library
Credit points	*2 SKS which equivalent to 12 ECTS*
Requirements according to the examination regulations	*Collecting of progress report for scientific publication and the proof*

Required and recommended prerequisites for joining the module	*Existing competencies in scientific writing*
Module objectives/intended learning outcomes	• Able to compile scientific articles based on research results. • Able to communicate research results in written and or oral form.
Content	• Identification of national and international scientific publications; • Progress reports of writing scientific publications; • Progress reports of the submission process to the seminar/journal.
Exams and assessment formats	Mid-semester progress report assessment, final progress report assessment.
Study and examination requirements	Requirements for successfully passing the module. The final grade in the module is composed of 60% performance on progress reports, 20% the kinds of publication (seminar or journal), 20% the publication level (national or international). Students must have a complete draft of publication as a minimum reached to pass.
Reading list	Grech, V. and Cuschieri, S., 2018. Write a Scientific Paper (WASP)-a Career-Critical Skill. *Early Human Development*, *117*, pp.96-97. Black, M., 2018. *Critical Thinking: An Introduction to Logic and Scientific Method*. Pickle Partners Publishing. Jirge, P.R., 2017. Preparing and Publishing a Scientific Manuscript. *Journal of Human Reproductive Sciences*, *10*(1), p.3. Parija, S.C. and Kate, V., 2017. Why Write a Scientific Research Paper. In *Writing and Publishing a Scientific Research Paper* (pp. 3-8). Springer, Singapore. Paul, J. and Criado, A.R., 2020. The Art of Writing Literature Review: What Do We Know and What Ddo We Need to Know? *International Business Review*, *29*(4), p.101717. Alspach, J.G., 2017. Writing for Publication 101: Why the Abstract is so Important. *Critical Care Nurse*, *37*(4), pp.12-15.

6.4.8. Research 2 dan Seminar of Result Phase 2

Module designation	Research 2 dan Seminar of Result Phase 2
Code, if applicable	C IL 2 3 842
Semester(s) in which the module is taught	4th
Person responsible for the module	Head of Study Program; Principal Supervisor & Co Supervisor
Language	*Indonesian and English*
Relation to curriculum	*Compulsory*
Type of teaching, contact hours	• Discussion with Principal Supervisor (32 hours, 2 hours weekly for 16 weeks) • Discussion with Co Supervisor (32 hours, 2 hours weekly for 16 weeks) • Developing data collection strategy (160 hours, 10 hours weekly for 16 weeks) • Developing data analysis strategy (144 hours, 9 hours weekly for 16 weeks) • Preparing progress report (±50 hours, 3.2 hours weekly for 16 weeks) • Preparing presentation materials (32 hours, 2 hours weekly for 16 weeks) Total hours in 1 semester = 450 hours
Student Workload for One ECTS	• Face-to-face discussion with Principal Supervisor (1.78 hours) • Face-to-face discussion with Co-Supervisor (1.78 hours) • Developing research conceptual and pathway framework in data collection (8.89 hours) • Developing research conceptual and pathway framework in data analysis (8.89 hours) • Preparing progress report (improvements, challenges, constraints, etc.: 2.78 hours) • Preparing presentation materials for discussion with supervisors (1.78 hours) Total workload for one ECTS: 25 hours
Laboratory Work	Students taking this course have the chance to utilize the laboratory within the Diponegoro University according to each student's research needs
Credit points	*3 SKS which equivalent to 18 ECTS*

Requirements according to the examination regulations	Participate in monitoring and evaluating progress of the preparation of the dissertation organized by the Study Program; Collecting of portfolio of progress report for dissertation.
Required and recommended prerequisites for joining the module	Existing competencies in research methodology and scientific writing.
Module objectives/intended learning outcomes	• Able to design research according to scientific research methodology. • Able to carry out scientific research for doctoral program dissertation.
Content	• Operational definitions, indicators, and research variables; • Theoretical framework and research concept framework; Population, sample & research variables; • Techniques of data collection; • Methods of research data analysis; • Portfolio of progress reports of the dissertation draft.
Exams and assessment formats	Mid-semester progress report assessment, final progress report assessment.
Study and examination requirements	Requirements for successfully passing the module The final grade in the module is composed of 80% performance on portfolio of progress reports, 20% participation in monitoring and evaluating. Students must submit a portfolio of progress reports and a draft dissertation according to the targeted stages as a minimum achievement to pass.

Reading list	Modul of Writing Dissertation DES Glatthorn, A. A., & Joyner, R. L. (2005). Writing the Winning Thesis or Dissertation: A Step-by-Step Guide. Corwin Press. Kasperson, J. X., Kasperson, R. E., Turner, B. L., Hsieh, W., & Schiller, A. (2022). Vulnerability to Global Environmental Change. In the Social Contours of Risk (pp. 245-285). Routledge. Louv, R., & Fitzpatrick, J. W. (2012). Citizen Science: Public Participation in Environmental Research. Cornell University Press. Pohl, C. (2005). Transdisciplinary Collaboration in Environmental Research. Futures, 37(10), 1159-1178. Randolph, J. (2009). A Guide to Writing the Dissertation Literature Review. Practical Assessment, Research, and Evaluation, 14(1), 13. Svarstad, H., Petersen, L. K., Rothman, D., Siepel, H., & Wätzold, F. (2008). Discursive Biases of the Environmental Research Framework DPSIR. Land Use Policy, 25(1), 116-125

6.4.9. Scientific Publication 2

Module designation	*Scientific Publication 2*
Code, if applicable	C IL 2 3 843
Semester(s) in which the module is taught	*4th*
Person responsible for the module	Head of Study Program; Principal Supervisor & Co Supervisor
Language	English
Relation to curriculum	Compulsory
Type of teaching, contact hours	• Discussion with Principal Supervisor (24 hours, 1.5 hours weekly for 16 weeks). • Discussion with Co Supervisor (24 hours, 1.5 hour weekly for 16 weeks). • Preparing manuscript (128 hours, 8 hours weekly for 16 weeks). • Finalizing research result for publication (56 hours, 3.5 hours weekly for 16 weeks). • Preparing presentation materials (36 hours, 2.25 hours weekly for 16 weeks). • Proofreading (32 hours, 2 hours weekly for 16 weeks). Total hours in 1 semester = 300 hours
Student Workload for One ECTS	• Face-to-face discussion with Principal Supervisor (2 hours) • Face-to-face discussion with Co-Supervisor (2 hours) • Writing manuscript from zero to camera ready version (10.67) • Personal work on finalizing research result data analysis for publication (4.67 hours) • Preparing presentation materials (3 hours) • Proofreading the final version of manuscript (2.67 hours) Total workload: 25 hours
Laboratory Work	There is no required laboratory work for this course. On the other hand, student taking this course might utilize the Diponegoro University's Library, Manuscript Consultation Center from LPPM, and the School of Postgraduate Studies' Library
Credit points	*3 SKS which equivalent to 12 ECTS*
Requirements according to the examination regulations	*Collecting of progress report for scientific publication and the proof*

Required and recommended prerequisites for joining the module	Existing competencies in scientific writing for international publication.
Module objectives/intended learning outcomes	• Able to compile scientific articles for international publication based on research results. • Able to communicate research results in written and or oral form in international journals or seminars.
Content	• Identification of international scientific publications (seminar and journal); • Progress reports of writing scientific publications; • Progress reports of the submission process to the seminar/journal.
Exams and assessment formats	Mid-semester progress report assessment, final progress report assessment.
Study and examination requirements	Requirements for successfully passing the module The final grade in the module is composed of 60% performance on progress reports, 20% the kinds of publication (seminar or journal), 20% the publication level (reputable or not). Students must have a complete draft of publication as a minimum reached to pass.
Reading list	Alspach, J.G., 2017. Writing for Publication 101: Why the Abstract is So Important. *Critical Care Nurse*, *37*(4), pp.12-15. Black, M., 2018. *Critical Thinking: An Introduction to Logic and Scientific Method*. Pickle Partners Publishing. Jirge, P.R., 2017. Preparing and Publishing a Scientific Manuscript. *Journal of Human Reproductive Sciences*, *10*(1), p.3. Parija, S.C. and Kate, V., 2017. Why Write a Scientific Research Paper. In *Writing and Publishing a Scientific Research Paper* (pp. 3-8). Springer, Singapore. Paul, J. and Criado, A.R., 2020. The Art of Writing Literature Review: What Do We Know and What Do We Need to Know? *International Business Review*, *29*(4), p.101717. Grech, V. and Cuschieri, S., 2018. Write a Scientific Paper (WASP)-a Career-Critical Skill. *Early Human Development*, *117*, pp.96-97.

6.4.10. Research 3 dan Seminar of Result Phase 3

Module designation	Research 3 and Seminar of Result Phase 3
Code, if applicable	C IL 2 3 851
Semester(s) in which the module is taught	5rd
Person responsible for the module	Head of Study Program; Principal Supervisor & Co Supervisor
Language	*Indonesian and English*
Relation to curriculum	*Compulsory*
Teaching methods	*Progress Report, Presentation, Discussion.*
Type of teaching, contact hours	• Discussion with Principal Supervisor (32 hours, 2 hours weekly for 16 weeks). • Discussion with Co-Supervisor (32 hours, 2 hours weekly for 16 weeks). • Data analysis (96 hours, 6 hours weekly for 16 weeks). • Developing research result discussion (96 hours, 6 hours weekly for 16 weeks). • Preparing progress report (24 hours, 1.5 hour weekly for 16 weeks). • Preparing presentation materials (20 hours, 1.25 hour weekly for 16 weeks). Total hours in 1 semester = 300 hours
Student Workload for One ECTS	• Face-to-face with Principal Supervisor (2.67 hours) • Face-to-face with Co-Supervisor (2.67 hours) • Validating research conceptual and pathway framework in data analysis (8 hours) • Validating research conceptual and pathway framework in data collection (8 hours) • Preparing progress report (improvements, challenges, constraints, etc.: 2 hours) • Preparing presentation materials (1.67) • Total workload for one ECTS : 25 hours
Laboratory Work	Students taking this course have the chance to utilize the laboratory within the Diponegoro University according to each student's research needs
Credit points	3 SKS which equivalent to 12 ECTS
Requirements according to the examination regulations	Participate in monitoring and evaluating progress of the preparation of the dissertation organized by the Study Program; Collecting of portfolio of progress report for dissertation.

Required and recommended prerequisites for joining the module	Existing competencies in data analysis and scientific writing.
Module objectives/intended learning outcomes	• Able to display research results visually and in writing. • Able to perform data analysis of scientific research results. • Able to draw conclusions on research results.
Content	• Primary and secondary data collection; • Presentation of data in the form of tables and graphs; • Research data processing; Analysis of data processing results; • Compilation of conclusions on the dissertation; • Portfolio of progress reports of the dissertation draft
Exams and assessment formats	Mid-semester progress report assessment, complete dissertation draft, eligibility test.
Study and examination requirements	The final grade in the module is composed of 80% performance on portfolio of progress reports, 20% participation in monitoring and evaluating. Students must submit a portfolio of progress reports and a draft dissertation according to the targeted stages as a minimum achievement to pass.
Reading list	Allison, B., & Race, P. (2004). The Student's Guide to Preparing Dissertations and Theses. Routledge. Arrows, F. (2008). The Authentic Dissertation. London: Routledge. Joyner, R. L., Rouse, W. A., & Glatthorn, A. A. (2018). Writing the Winning Thesis or Dissertation: A Step-by-Step Guide. Corwin Press. Modul of Writing Dissertation DES Ramlaul, A. (2020). Dissertation Structure and Presentation. In Medical Imaging and Radiotherapy Research: Skills and Strategies (pp. 363-380). Springer, Cham.

6.4.11. Dissertation Feasibility Examination

Module designation	Dissertation Feasibility Examination
Module level, if applicable	-
Code, if applicable	C IL 2 3 852
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	5th Semester
Person responsible for the module	• Main advisory lecturer
Lecturer	• Principal Supervisor • Co Supervisor
Language	*Indonesian and English*
Relation to curriculum	Students are able to eligibility examination
Type of teaching, contact hours	• Discussion with Principal Supervisor (16 hours, 1 hours weekly for 16 weeks). • Discussion with Co Supervisor (16 hours, 1 hours weekly for 16 weeks). • Preparing dissertation full report (84 hours, 5.25 hours weekly for 16 weeks). • Preparing presentation (34 hours, 2.15 hour weekly for 16 weeks). Total hours in 1 semester = 150 hours
Workload	• Face-to-face discussion with Principal Supervisor (2.67 hours) • Face-to-face discussion with Co-Supervisor (2.67 hours) • Evaluating in major research data analysis (processing, quantify, optimation analysis (14 hours) • Preparing presentation materials and progress report (improvements, challenges, constraints, etc.: 5.67 hours) Total workload for one ECTS : 25 hours
Laboratory Work	There is no required laboratory work for this course.
Credit points	2 credits which is equivalent to 6 ECTS
Requirements according to the examination regulations	Minimum attendance of lectures 75% Further detail on examination regulation could be accessed through this link: http://dil.pasca.undip.ac.id/dissertation-feasibility-exam/
Recommended prerequisites	-
Module objectives/intended learning outcomes	-

Content	-
Study and examination requirements and forms ofexamination	• Open book and close book • Journal publications, case studies, interviews
Media employed	Power point, YouTube, website
Reading Materials	Happell, B. (2009). Presenting with Precision: Preparing and Delivering a Polished Conference Presentation. Nurse Researcher, 16(3). Jackson, D., Davidson, P. M., & Usher, K. (2022). Preparing for Examination. In Successful Doctoral Training in Nursing and Health Sciences (pp. 119-131). Springer, Cham. Matteson, S. M., & DeLozier, R. W. (2022). Insights Into Undertaking a Three-Article Dissertation. In Methodological Innovations in Research and Academic Writing (pp. 240-259). IGI Global.

6.4.12. Scientific Publications 3

Module designation	Scientific Publication 3
Code, if applicable	C IL 2 3 853
Semester(s) in which the module is taught	5th
Person responsible for the module	Head of Study Program; Principal Supervisor & Co Supervisor
Language	*English*
Relation to curriculum	*Compulsory*
Type of teaching, contact hours	• Discussion with Principal Supervisor (24 hours, 1.5 hours weekly for 16 weeks). • Discussion with Co Supervisor (24 hours, 1.5 hour weekly for 16 weeks). • Preparing manuscript (128 hours, 8 hours weekly for 16 weeks). • Finalizing research result for publication (64 hours, 4 hours weekly for 16 weeks). • Preparing presentation materials (32 hours, 2 hours weekly for 16 weeks). • Proofreading (28 hours, 1.75 hours weekly for 16 weeks). Total hours in 1 semester = 300 hours
Student Workload for one ECTS	• Face-to-face discussion with Principal Supervisor (2 hours) • Face-to-face discussion with Co-Supervisor (2 hours) • Writing manuscript from zero to camera ready version (10.67 hours) • Personal work on finalizing research result data analysis for publication (5.33 hours) • Preparing presentation materials (2.67 hours) • Proofreading the final version of manuscript (2.33 hours) • Total workload for one ECTS : 25 hours
Laboratory Work	There is no required laboratory work for this course. On the other hand, student taking this course might utilize the Diponegoro University's Library, Manuscript Consultation Center from LPPM, and the School of Postgraduate Studies' Library
Credit points	*3 SKS which equivalent to 12 ECTS*

Requirements according to the examination regulations	Collecting of progress report for scientific publication and the proof
Required and recommended prerequisites for joining the module	Existing competencies in scientific writing for international publication.
Module objectives/intended learning outcomes	• Able to compile scientific articles for a reputable international journal based on research results. • Able to communicate research results in written form in reputable international journals.
Content	• Identification of international scientific publications (seminar and journal); • Progress reports of writing scientific publications; • Progress reports of the submission process to the seminar/journal.
Exams and assessment formats	Mid-semester progress report assessment, final progress report assessment.
Study and examination requirements	Requirements for successfully passing the module The final grade in the module is composed of 80% performance on progress reports, 20% kinds of publication (level of the reputable international journal). Students must have a complete draft of publication as a minimum reached to pass.
Reading list	Alspach, J.G., 2017. Writing for Publication 101: Why the Abstract is So Important. *Critical Care Nurse*, *37*(4), pp.12-15. Black, M., 2018. *Critical Thinking: An Introduction to Logic and Scientific Method*. Pickle Partners Publishing. Grech, V. and Cuschieri, S., 2018. Write a Scientific Paper (WASP)-a Career-Critical Skill. *Early Human Development*, *117*, pp.96-97. Jirge, P.R., 2017. Preparing and Publishing a Scientific Manuscript. *Journal of Human Reproductive Sciences*, *10*(1), p.3. Parija, S.C. and Kate, V., 2017. Why Write a Scientific Research Paper. In *Writing and Publishing a Scientific Research Paper* (pp. 3-8). Springer, Singapore. Paul, J. and Criado, A.R., 2020. The art of Writing Literature Review: What Do We Know and What Do We Need to Know? *International Business Review*, *29*(4), p.101717.

Dissertation Defence

Module designation	Dissertation Defence
Module level, if applicable	
Code, if applicable	C IL 2 3 861
Subtitle, if applicable	
Courses, if applicable	
Semester(s) in which themodule is taught	6th Semester
Person responsible for the module	• Main advisory lecturer
Lecturer	Principal Supervisor & Co Supervisor
Language	*Indonesian and English*
Relation to curriculum	-
Type of teaching, contact hours	• Discussion with Principal Supervisor (24 hours, 1.5 hours weekly for 16 weeks). • Discussion with Co Supervisor (20 hours, 1.25 hour weekly for 16 weeks). • Revising and finalizing dissertation full report (128 hours, 8 hours weekly for 16 weeks). • Proofreading and copy-editing dissertation (48 hours, 3 hours weekly for 16 weeks). • Preparing presentation (48 hours, 3 hours weekly for 16 weeks). • Peer discussion (16 hours, 1 hours weekly for 16 weeks). • Administrative work (16 hours, 1 hour weekly for 16 weeks). Total hours in 1 semester = 300 hours
Student Workload for One ECTS	• Face-to-face discussion with Principal Supervisor (2 hours) • Face-to-face discussion with Co-Supervisor (2 hours) • Revising and finalizing dissertation full report (10.67 hours) • Proofreading and copy-editing dissertation (4 hours) • Preparing presentation final assessment of complete dissertation by supervisors and judges (4 hours) • Improvement for full dissertation, and peer discussion (1.33 hours) • Administrative work (1.33 hours) Total workload for one ECTS : 25 hours
Laboratory Work	There is no required laboratory work for this course

Credit points	5 SKS or equivalent to 12 ECTS
Requirements according to the examination regulations	Minimum attendance of lectures 75% Further detail on the requirements for taking Doctoral Defence could be accessed through this link: http://dil.pasca.undip.ac.id/dissertation-defence/
Recommended prerequisites	-
Module objectives/intended learning outcomes	-
Content	-
Study and examination requirements and forms ofexamination	• Open book and close book • Journal publications, case studies, interviews
Media employed	Power point, youtube, website
Reading Materials	Rockinson-Szapkiw, A. J., & Spaulding, L. S. (2014). Navigating the Doctoral Journey: A Handbook of Strategies for Success. Rowman & Littlefield. Matteson, S. M., & DeLozier, R. W. (2022). Insights Into Undertaking a Three-Article Dissertation. In Methodological Innovations in Research and Academic Writing (pp. 240-259). IGI Global. Tribe, R., & Marshall, C. (2020). Preparing for a Conference, Doctoral or Professional Presentation. Counselling Psychology Review, 35(2), 30-39.

6.4.13. Doctoral Promotion

Module designation	Doctoral Promotion
Module level, if applicable	-
Code, if applicable	CIL 23862
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	6th Semester
Person responsible for the module	• Main advisory lecturer
Lecturer	Principal Supervisor & Co Supervisor
Language	*Indonesian and English*
Relation to curriculum	-
Type of teaching, contact hours	• Discussion with Principal Supervisor (24 hours, 1.5 hours weekly for 16 weeks). • Discussion with Co Supervisor (24 hours, 1.5 hour weekly for 16 weeks). • Revising and Finalizing Dissertation Full Report (132 hours, 8.25 hours weekly for 16 weeks). • Finalizing publication and other administrative work (120 hours, 7.5 hours weekly for 16 weeks). Total hours in 1 semester = 300 hours
Student Workload for One ECTS	• Face-to-face discussion with Principal Supervisor (2 hours) • Face-to-face discussion with Co-Supervisor (2 hours) • Revising and finalizing dissertation full report (11 hours) • Proofreading, copy-editing dissertation, Improvement for full dissertation, peer discussion and administrative work (10 hours) Total workload for one ECTS : 25 hours
Laboratory Work	There is no required laboratory work for this course
Credit points	3 SKS which equivalent to 12 ECTS
Requirements according to the examination regulations	Minimum attendance of lectures 75%
Recommended prerequisites	-
Module objectives/intended learning outcomes	-

Content	-
Study and examination requirements and forms ofexamination	• Open book and close book • Journal publications, case studies, interviews
Media employed	Power point, YouTube, website
Reading Materials	Bailey, D. (2019). The Doctoral Journey Engaged: Elements to Persist. Doctoral Student Perspectives on Motivation and Persistence: Eye-Opening Insights into the Ideas and Thoughts That Today's Doctoral Students Have About Finishing the Doctoral Degree, 5. Tribe, R., & Marshall, C. (2020). Preparing for a Conference, Doctoral or Professional Presentation. Counselling Psychology Review, 35(2), 30-39. Virtanen, V., & Pyhältö, K. (2012). What Engages Doctoral Candidates in Biological and Environmental Science to Doctoral Studies? Psychology.

6.5. Elective Courses

By Course pathway in Doctoral Program of Environmental Science offers elective courses as follows:

No	Code	Course	Credits	
			SKS	ECTS
1	C IL 2 3 821	Environmental Planning	2	6
2	C IL 2 3 822	Environmental Ethics	2	6
3	C IL 2 3 823	Environmental Management	2	6
4	C IL 2 3 824	Audit and Environmental Management System	2	6
5	C IL 2 3 825	Concepts of Pollution Control and Environmental Degradation	2	6
6	C IL 2 3 826	Biodiversity and Ecosystem	2	6
7	C IL 2 3 827	Energy and Environmental	2	6

Students are required to choose at least 2 elective courses (Credits: 4 SKS or equivalent to 12 ECTS). The detail of each course would be described in the following sub sections:

6.5.1. Environmental Planning

Module designation	Environmental Planning
Module level, if applicable	-
Code, if applicable	C IL 2 3 821
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	2nd Semester
Person responsible for the module	Prof. Drs. Sudharto Prawata Hadi, MES, Ph.D.
Lecturer	1. Prof. Drs. Sudharto Prawata Hadi, MES, Ph.D. 2. Dr. Hartuti Purnaweni, MPA.
Language	*Indonesian and English*
Relation to curriculum	Students are able to explain the components and basic conceptsof planning
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes. • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks).

	• Preparing paper and final personal assignment (40 hours, 2.5 hours weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (22 hours, 1.35 hour weekly for 16 weeks). Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (6.67 hours) • Independent work (reading books, materials, papers, literature review, etc. : 8 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 6.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (3.67 hours) • Total workload for one ECTS = 25 hours
Laboratory Work	There is no required laboratory work for this course
Credit points	2 SKS which is equivalent to 6 ECTS
Requirements according to the examination regulations	*Minimum attendance of lectures 75%*
Recommended prerequisites	-
Module objectives/intended learning outcomes	• Understand planning, planning processes and planningaspects. • Understand the types of planning components. • Understand the concept of spatial planning. • Able to identify the application of planning in regional spatial planning.
Content	• This course examines planning planning processes and planningaspects, • The application of environmental planning in sustainable spatial planning.
Study and examination requirements and forms ofexamination	• Open book and close book • Journal publications, case studies, interviews
Media employed	Power point, YouTube, website
Reading Materials	Faludi, A. (2013). A Decision-Centered View of Environmental Planning (Vol. 38). Elsevier. Lahdelma, R., Salminen, P., & Hokkanen, J. (2000). Using Multicriteria Methods in Environmental Planning and Management. Environmental Management, 26(6), 595-605. Westman, W. E. (1984). Ecology, Impact Assessment, and Environmental Planning. Wu, J., & Chang, I. (2020). Environmental Planning. In Environmental Management in China (pp. 17-34). Springer,

	Singapore.

6.5.2. Environmental Ethics

Module designation	Environmental Ethics
Code, if aplicable	C IL 2 3 822
Semester(s) in which the module is taught	2nd
Person responsible for the module	Prof. Drs. Sudharto Prawata Hadi, MES, Ph.D.
Language	Indonesian and English
Relation to curriculum	Elective
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes. • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (40 hours, 2.5 hours weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (22 hours, 1.35 hour weekly for 16 weeks). Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (6.67 hours) • Independent work (reading books, materials, papers, literature review, etc. : 8 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 6.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (3.67 hours) • Total workload for one ECTS = 25 hours
Laboratory Work	There is no required laboratory work for this course
Credit points	2 SKS which is equivalent to 6 ECTS
Requirements according to the examination regulations	Minimum attendance of lectures 75%
Required and recommendedprerequisites for joining the module	Existing competencies in ecology

Module objectives/intended learning outcomes	• Able to analyze the application of the essence of ethicsand environmental ethics. • Able to explain the relationship between humans and theenvironment. • Able to examine the practices of pan cosmism, anthropocentric era, deep ecology, and shallow ecology.
Content	• Understanding ethics, environmental ethics and human relations, • Understanding pan-cosmism, environmental wisdom and deep ecology (characteristics, implications, and sustainability), • Understanding anthropocentric stages and shallow ecology (characteristics, forms, examples, and implications), • Understanding shifting values due to globalization, commercialization, and privatization, environmental rights & justice, • Understanding holism stages (several forms of new/rational wisdom, newforms of institutional wisdom, new forms of individual wisdom).
Exams and assessment formats	One oral Midterm assessment (15 minutes each), one final oral exam (20 minutes), take-home written assignments.
Study and examination requirements	Requirements for successfully passing the module e.g. the final grade in the module is composed of 60% performanceon exams, 20% take-home assignments, 20% in-classparticipation. Students must have a final grade of 60% or higher topass.
Reading Materials	Boylan, M. (Ed.). (2022). Environmental Ethics. John Wiley & Sons. Des Jardins, J. R. (2012). Environmental Ethics. Cengage Learning. Palmer, C., McShane, K., & Sandler, R. (2014). Environmental Ethics. Annual Review of Environment and Resources, 39, 419-442. Salgueiro, I. (2022). Ethics and Sustainability: The Role of Sustainable Policy Evaluation Tests. In Corporate Responsibility, Sustainability and Markets (pp. 215-232). Palgrave Macmillan, Cham.

6.5.3. Environmental Management

Module designation	Environmental Management
Module level, if applicable	-
Code, if applicable	C IL 2 3 823
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which themodule is taught	2nd Semester
Person responsible for the module	Prof. Drs. Sudharto Prawata Hadi, MES, Ph.D.
Lecturer	1. Prof. Drs. Sudharto Prawata Hadi, MES, Ph.D. 2. Prof. Dr. Ir. Azis Nur bambang M.S.
Language	*Indonesian and English*
Relation to curriculum	Students are able to explain the general picture, different viewson environmental problems, case examples and global environmental issues isu
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes. • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (40 hours, 2.5 hours weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (22 hours, 1.35 hour weekly for 16 weeks). Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (6.67 hours) • Independent work (reading books, materials, papers, literature review, etc. : 8 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 6.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (3.67 hours) • Total workload for one ECTS = 25 hours
Laboratory Work	*There is no required laboratory work for this course*
Credit points	*2 SKS which is equivalent to 6 ECTS*

Requirements according to the examination regulations	*Minimum attendance of lectures 75%*
Recommended prerequisites	-
Module objectives/intended learning outcomes	• Understand the functions: management, planning, organizing,coordinating & directing, implementing and controlling • Understand the techniques: management, time and resourceplanning, optimization of resource allocation • Understand decision-making techniques in managementinformation systems, especially in the field of environmental • science
Content	• Able to understand and explain environmental problems, • Able to understand surroundings and global issues regarding the environment, • Able to understand the carrying capacity of nature in relation to the environment, • Able to understand the problem of environmental pollution impacts along with solutions to reduce impacts with applicable quality standards • Able to explain and implement environmentally sound development) as well as AMDAL and environmental laws and regulations in force in Indonesia.
Study and examination requirements and forms ofexamination	• *Open book and close book* • *Multiple choice, case studies, interviews*
Media employed	Power point, YouTube, website
Reading Materials	Barrow, C. (2006). Environmental Management for Sustainable Development. Routledge. He, L., Shen, J., & Zhang, Y. (2018). Ecological Vulnerability Assessment for Ecological Conservation and Environmental Management. Journal of Environmental Management, 206, 1115-1125. Muller, S., Hemming, S., & Rigney, D. (2019). Indigenous Sovereignties: Relational Ontologies and Environmental Management. Geographical Research, 57(4), 399-410. Raymond, C. M., Fazey, I., Reed, M. S., Stringer, L. C., Robinson, G. M., & Evely, A. C. (2010). Integrating Local and Scientific Knowledge for Environmental Management.

	Journal of Environmental Management, 91(8), 1766-1777.

6.5.4. Audit and Environmental Management System

Module designation	Audit and Environmental Management System
Module level, if applicable	-
Code, if applicable	CIL 23824
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	2nd Semester
Person responsible for the module	Prof. Dr. Ir. Purwanto, DEA
Lecturer	Prof. Dr. Ir. Purwanto, DEA Prof. Dr. Ir. Azis Nur Bambang, MS; Dr. Henna Rya Sunoko, Apt., MES
Language	Indonesian and English
Relation to curriculum	Elective
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes. • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (40 hours, 2.5 hours weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (22 hours, 1.35 hour weekly for 16 weeks). Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (6.67 hours) • Independent work (reading books, materials, papers, literature review, etc. : 8 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 6.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (3.67 hours) Total workload for one ECTS = 25 hours
Laboratory Work	*There is no required laboratory work for this course*
Credit points	*2 SKS which is equivalent to 6 ECTS*
Requirements according to the examination	Minimum attendance of lectures 75%

regulations	
Recommended prerequisites	-
Module objectives/intended learning outcomes	• Able to explain the basic principles of Environmental Management System • Able to explain the causes and benefits of environmental audits and the type of audit • Able to explain the stages of environmental audit • Able to implement Environmental policy • Able to analyze differences in environmental auditors and environmental audits in Indonesia
Content	• Definition of audit scope of environment definition of environmental audit, • Auditing as a component from management milieu, • Philosophy Management basic environment Auditing in the context of environmental risks, • Causes and benefits of environmental audits, • Stages of environmental audit • Audit Preparation, • Audit Implementation, • Audit Data Analysis • Audit Data Reporting, • Pre and Post audit Activities, • Environmental auditors Environmental Audit in Indonesia, • Understanding, History, Roles and Characteristics of Environmental Management System Elements, • Models and basic principles of Environmental Management System, • Process Management Organizational Principles HR Aspects Policy Making Process and Analysis, • SML Requirements Environmental Policy Environmental Aspects, • Deployment and Operation Human resources Competence control Alertness, • SML Monitoring and Measurement Setup Evaluation, • Management Overview

Study and examination requirements and forms ofexamination	• Open book and close book Multiple choice, case studies, interviews
Media employed	Power point, youtube, website
Reading Materials	Aslam, S., Rehman, R. U., & Asad, M. (2020). Linking Environmental Management Practices to Environmental Performance: The interactive Role of Environmental Audit. *Pakistan Journal of Commerce and Social Sciences (PJCSS)*, *14*(1), 99-119. Earnhart, D., & Harrington, D. R. (2021). Effects of Audit Frequency, Audit Quality, and Facility Age on Environmental Compliance. *Applied Economics*, *53*(28), 3234-3252 Hakim, W., & Yunus, A. (2017). Environmental Audit as Instrument for Environmental Protection and Management. *The Business & Management Review*, *9*(2), 228-232. Kuhre, W. L. (2018). *ISO 14001 Certification: Environmental Management System*. Prentice Hall.

6.5.5. Concepts of Pollution Control and Environmental Degradation

Module designation	Concepts of Pollution Control and Environmental Degradation
Code, if aplicable	C IL 2 3 825
Semester(s) in which the module is taught	2nd
Person responsible for the module	Prof. Dr. Ir. Purwanto, DEA
Language	Indonesian and English
Relation to curriculum	Elective
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes. • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (40 hours, 2.5 hours weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (22 hours, 1.35 hour weekly for 16 weeks). Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (6.67 hours) • Independent work (reading books, materials, papers, literature review, etc. : 8 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 6.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (3.67 hours) • Total workload for one ECTS = 25 hours
Laboratory Work	*There is no required laboratory work for this course*
Credit points	*2 SKS which is equivalent to 6 ECTS*
Requirements according to the examination regulations	Minimum attendance of lectures 75%
Required and recommended prerequisites for joining the module	Existing competencies in ecology

Module objectives/intended learning outcomes	• Able to analyze environmental pollution and its sources. • Able to examine various implications of pollution on quality and environmental degradation. • Able to evaluate pollution control along with disaster mitigation and recovery.
Content	• Definition of environmental pollution and pollutant sources, control of water environment pollution, • control of air environmental pollution, • control of soil environmental pollution, • implications of pollution on environmental degradation and environmental degradation, • possibilities of environmental disasters due to pollution, • principles of pollution control from the perspective of physics-chemistry, biology, and health, • principles of pollution control from community participation, • principles of disaster mitigation and recovery, • case studies of pollution in the air environment, • case studies of pollution in the hospital environment, • case studies of pollution in the hotel environment, • study cases of pollution in industrial areas, • case studies of pollution in urban areas.
Exams and assessment formats	One oral Midterm assessment (15 minutes each), one final oral exam (20 minutes), take-home written assignments.
Study and examination requirements	
Reading list	Alley, K. D., & Mehta, T. (2022). Contradictions In Pollution Control. Climate Politics and the Power of Religion, 119. Cheremisinoff, N.P., 2002. Handbook of Air Pollution Prevention and Control. Elsevier. Eskeland, G. S., & Jimenez, E. (1991). Choosing Policy Instruments for Pollution Control: A Review. Policy Research Working Paper Series, (624). Rao, C.S., 2007. Environmental Pollution Control Engineering. New Age International. Van Der Ploeg, F., & De Zeeuw, A. J. (1992). International Aspects of Pollution Control. Environmental and Resource Economics, 2(2), 117-139. Vesilind, P.A., Peirce, J.J. and Weiner, R.F., 2013. Environmental Pollution and Control. Elsevier. Wardhana, W.A., 2004. Dampak Pencemaran Lingkungan (Edisi Revisi). Yogyakarta: Penerbit Andi.

Biodiversity and Ecosystem

Module designation	Biodiversity and Ecosystem
Code, if applicable	C IL 2 3 826
Semester(s) in which the module is taught	2nd
Person responsible for the module	Prof. Dr. Tri Retnaningsih Soeprobowati, M.App.Sc.
Language	*Indonesian and English*
Relation to curriculum	*Elective*
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes. • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks). • Preparing paper and final personal assignment (40 hours, 2.5 hours weekly for 16 weeks). • Personal work on reflecting the course's gained knowledge to the student's research topic (22 hours, 1.35 hour weekly for 16 weeks). Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (6.67 hours) • Independent work (reading books, materials, papers, literature review, etc. : 8 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 6.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (3.67 hours) • Total workload for one ECTS = 25 hours
Laboratory Work	*There is no required laboratory work for this course*
Credit points	*2 SKS which is equivalent to 6 ECTS*
Requirements according to the examination regulations	*Minimum attendance of lectures 75%*
Required and recommended prerequisites for joining the module	*Existing competencies in ecology*

Module objectives/intended learning outcomes	• *Able to examine the potential of biological resources in terrestrial (land) and coastal marine areas.* • *Able to examine the relationship between humans, the natural environment, and the social environment as an ecosystem in utilizing natural resources in their environment.* • *Able to analyze the causes of changes in biodiversity.* • *Able to analyze biodiversity management strategies.*
Content	• Ecology and biodiversity of marine biological resources, • damage to ecosystems of marine biological resources, • ecology and diversity of terrestrial biological resources, POAC, • class discussion (approach to environmental management from bio geophysical, social, economic, cultural aspects).
Exams and assessment formats	*One oral Midterm assessment (15 minutes each), one final oral exam (20 minutes), take-home written assignments.*
Study and examination requirements	
Reading list	Loreau, M. and De Mazancourt, C., 2013. Biodiversity and Ecosystem Stability: A Synthesis of Underlying Mechanisms. *Ecology letters*, *16*, pp.106-115. Naeem, S., & Li, S. (1997). Biodiversity Enhances Ecosystem Reliability. Nature, 390(6659), 507-509. Schulze, E.D. and Mooney, H.A. eds., 2012. *Biodiversity and Ecosystem Function*. Springer Science & Business Media. Scherer-Lorenzen, M., Gessner, M. O., Beisner, B. E., Messier, C., Paquette, A., Petermann, J. S., ... & Nock, C. A. (2022). Pathways for Cross-Boundary Effects of Biodiversity on Ecosystem Functioning. Trends in Ecology & Evolution. Sudharto, P.H., 2013. Manusia dan Lingkungan. *Balai Pustaka: Undip*. Tilman, D., Isbell, F. and Cowles, J.M., 2014. Biodiversity and Ecosystem functioning. *Annual Review of Ecology, Evolution, and Systematics*, *45*, pp.471-493.

6.5.6. Energy and Environmental

Module designation	Energy and Environmental
Code, if applicable	CIL 23827
Semester(s) in which the module is taught	2nd
Person responsible for the module	Dr. Ir. Hermawan, DEA
Language	*Indonesian and English*
Relation to curriculum	*Elective*
Teaching methods	*Lecture, Discussion (Q & A), Presentation.*
Type of teaching, contact hours	• Regular meeting with Lecturer 16 times (40 hours with total contact hour per teaching is 2.5 hours weekly for 16 weeks). This activity consists of Lecture: 80 minutes; Q&A: 20 minutes; Discussion: 30 minutes; Presentation: 20 minutes. • Independent work on reading materials and literature review (48 hours, 3 hours weekly for 16 weeks) • Preparing paper and final personal assignment (40 hours, 2.5 hours weekly for 16 weeks) • Personal work on reflecting the course's gained knowledge to the student's research topic (22 hours, 1.35 hour weekly for 16 weeks) Total contact hours in 1 semester = 150 hours
Student Workload for One ECTS	• Face-to-face Lecturers in class (6.67 hours) • Independent work (reading books, materials, papers, literature review, etc. : 8 hours) • Preparing paper and structured assignments (doing homework or assignments given by lecturers : 6.67 hours) • Personal work on reflecting the course's gained knowledge to the student's research topic (3.67 hours) • Total workload for one ECTS = 25 hours
Laboratory Work	*There is no required laboratory work for this course*
Credit points	*2 SKS which is equivalent to 6 ECTS*
Requirements according to the examination regulations	Minimum attendance of lectures 75%
Required and recommended prerequisites for joining the module	Existing competencies in renewable energy
Module objectives/intended learning outcomes	• Able to measure trends in energy use in the household, industrial, and transportation sectors and their impact on the environment.

	• Able to evaluate the use of renewable energy (technology, construction, and the impact on the environment) and the use of some waste as an energy source.
Content	• Energy use in household, industry & transportation sectors, • renewable energy sources, • fossil energy and the environment, • waste and the environment, • overall trends in energy use, • manufacturing energy in households, • energy in passenger & freight, • transpo-hydropower, • petroleum energy, • gas & coal energy, • biofuels, nuclear and fuel cells, • plastic waste & used tires, • livestock and human waste, • agricultural & plantation waste.
Exams and assessment formats	One oral Midterm assessment (15 minutes each), one final oral exam (20 minutes), take-home written assignments.
Study and examination requirements	
Reading list	Breeze, P., 2019. *Power Generation Technologies*. Newnes. Infield, D. and Freris, L., 2020. *Renewable Energy in Power Systems*. John Wiley & Sons. Dincer, I. (1998). Energy and Environmental Impacts: Present and Future Perspectives. Energy Sources, 20(4-5), 427-453. Gyamfi, B. A., Bein, M. A., Adedoyin, F. F., & Bekun, F. V. (2022). How Does Energy Investment Affect the Energy Utilization-Growth-Tourism Nexus? Evidence from E7 Countries. Energy & Environment, 33(2), 354-376. Hsieh, J. C. (2022). Study of Energy Strategy by Evaluating Energy–Environmental Efficiency. Energy Reports, 8, 1397-1409. Kumar, G., Kim, S. H., Lay, C. H., & Ponnusamy, V. K. (2020). Recent Developments on Alternative Fuels, Energy and Environment for Sustainability. Bioresource technology, 317, 124010. Loulou, R., Waaub, J.P. and Zaccour, G. eds., 2005. *Energy and Environment* (Vol. 3). Springer Science & Business Media. Sharma, R. K. (2022). Environmental Science. KK Publications. Singh, M. K., & Raghuvanshi, K. K. (2022). Defining and Visualizing Energy and Environment Related Smart

	Technologies. In Smart Technologies for Energy and Environmental Sustainability (pp. 21-38). Springer, Cham.

Appendix 1 Recommended Academic Progression

CODE	COURSES	CREDIT	
		SKS	ECTS
Matriculation			
-	Basic Understanding of Ecology	NC	-
-	Human Ecology	NC	-
-	Industrial Ecology	NC	-
-	Spatial and Environmental Dimensions	NC	-
-	Dimensions of Pollution and Environmental Damage	NC	-
Semester I			
C IL 2 3 811	Philosophy of Science and Research Methodology	3	9
C IL 2 3 812	Ecology and Global Environmental Change	3	9
C IL 2 3 813	System Analysis and Environmental Modelling	3	9
Total Credit Semester		**9**	**27**
Semester II			
C IL 2 3 823	Environmental Management	2	6
C IL 2 3 824	Audit and Environmental Management System	2	6
C IL 2 3 828	Scientific Articles Writing	3	6
C IL 2 3 829	Proposal Writing	3	15
Total Credit Semester		**10**	**33**
Semester III			
C IL 2 3 834	Research 1 and Seminar of Result Phase 1	4	18
C IL 2 3 836	Scientific Publications 1	2	12
Total Credit Semester		**6**	**30**
Semester IV			
C IL 2 3 842	Research 2 and Seminar of Result Phase 2	3	18
C IL 2 3 843	Scientific Publications 2	3	12
Total Credit Semester		**6**	**30**
Semester V			
C IL 2 3 851	Research 3 and Seminar of Result Phase 3	3	12
C IL 2 3 852	Dissertation Feasibility Examination	2	6
C IL 2 3 853	Scientific Publications 3	3	12
Total Credit Semester		**8**	**30**
Semester VI			
C IL 2 3 861	Dissertation Defence	5	12
C IL 2 3 862	Doctoral Promotion	3	12
Total Credit Semester		**8**	**24**
TOTAL Credits		**47**	**174**