ADDIS ABABA INSTITUTE OF TECHNOLOGY
SCHOOL OF CIVIL AND ENVIRONMENTAL ENGINEERING

Curriculum

PhD in Civil and Environmental Engineering

(With Specialization in Water Supply and Environmental Engineering)

August, 2024

Contents

Table of Abbreviations

ECTS	European Credit Transfer and Accumulation System
EIA	Environmental impact assessment
GPA	Grade Point Average
SAC	SCEE Academic Council
SCEE	School of Civil and Environmental Engineering
SGC	SCEE graduate committee
SUDS	Sustainable drainage systems

1. Background

Water scarcity, pollution, and climate change pose unprecedented challenges to global sustainability at large and sustainable growth in Ethiopia. Access to safe and adequate water supply is a fundamental human right, yet tens of millions lack this essential resource in Ethiopia and billions globally. Simultaneously, environmental degradation, driven by rapid urbanization, industrialization, and agricultural intensification, threatens ecosystems and human health both at local and global level. To address these complex and interconnected issues, highly skilled professionals with advanced knowledge in Water Supply and Environmental Engineering are urgently needed.

This PhD program in Water Supply and Environmental Engineering is intended for applicants worldwide, with the objective of fostering innovative leadership capable of developing and implementing sustainable solutions to pressing water and/or environment related challenges at local and global level. By integrating advanced engineering principles with interdisciplinary perspectives, the program aims to equip students with the expertise to conduct cutting-edge research, contribute to policy development, and drive technological advancements in the field.

Water supply and environmental engineering is a complex field encompassing various critical areas. Key among these is water supply analysis, which involves assessing water availability, demand, and quality, devising sustainable allocation strategies, and addressing challenges like scarcity and pollution. Ensuring public health requires robust water quality and treatment practices, including identifying emerging contaminants, developing advanced treatment technologies, and safeguarding drinking water supplies. Effective wastewater management and reuse are essential for environmental protection and resource recovery, entailing the design of efficient treatment systems, promoting water recycling, and extracting valuable byproducts. Understanding hydrological processes, modeling water flow, and managing water-related risks are core to environmental hydrology and hydraulics. Finally, given the pressing issue of climate change, assessing its impacts on water supply system and pollution, implementing adaptation measures, and contributing to mitigation efforts are crucial components of sustainable water and environmental management.

Through rigorous coursework, hands-on research, and collaborative projects, students will develop a deep understanding of the complex interplay between water, environment, and society. Graduates of this program will be prepared to address global water challenges and contribute to a sustainable future for all.

Graduates of a PhD in Water Supply and Environmental Engineering find diverse career opportunities. They can work for government agencies such as water boards and environmental protection authorities, contribute their expertise to consulting firms, and play a crucial role in operating water and wastewater treatment plants. Additionally, research and academic institutions benefit from their knowledge, and they can engage in environmental conservation through non-profit organizations. Furthermore, industries with high water consumption often employ these professionals to devise new approaches to manage their water supply and pollution problems efficiently.

The PhD in Water Supply and Environmental Engineering program typically has disciplinary roots in either engineering, specifically Civil Engineering with a strong focus on environmental and water-related aspects, or science with a specialization in water resources and engineering principles. In terms of institutional context, the program has been offered within school of Civil and Environmental Engineering (SCEE).

The PhD program will offer both standalone and joint degree options in collaboration with international partner institutions. This innovative approach aims to provide students with a comprehensive educational experience, combining rigorous academic training with global perspectives. By integrating curriculum,

faculty, and research resources from diverse academic environments, the program seeks to cultivate highly skilled and globally competent scholars capable of addressing complex challenges.

2. Rationale

The escalating global and national water challenges, exacerbated by climate change, population growth, and rapid urbanization, underscores an urgent need for innovative and sustainable solutions. A PhD program in Water Supply and Environmental Engineering is pivotal in addressing these challenges at individual, societal, business, national levels and use these as platform for knowledge expansion as described below.

- **Individual Needs:** The program is designed to meet a variety of individual needs. Students have the opportunity to advance their careers through academic or research pursuits, contributing meaningfully to knowledge creation and policy development. Furthermore, the program enhances technical and analytical skills, empowering graduates to address complex water supply and environmental related challenges. By fostering critical thinking and problem-solving abilities, the program equips individuals to develop and implement effective solutions.
- **Societal Needs:** By training experts in Water Supply and Environmental Engineering, the program contributes to sustainable development by addressing critical challenges related to clean water and sanitation, and fostering sustainable cities and communities, aligning with the Sustainable Development Goals. Furthermore, it plays a pivotal role in public health by developing strategies to ensure safe drinking water and sanitation, thereby reducing waterborne diseases. Lastly, the program safeguards ecosystems and biodiversity through research and innovation in water quality management and pollution control.
- **Business Needs:** The program addresses critical business needs by fostering innovation and competitiveness through the generation of new knowledge and technologies in Water Supply and Environmental Engineering. This enables businesses to develop innovative products and services. Additionally, it equips professionals with the skills to assess and manage water and environmental related risks, enhancing overall business resilience. By promoting water-efficient practices, the program contributes to reducing operational costs and minimizing environmental impact.
- **Contributions to Developing Nations:** The program contributes to developing nations through capacity building, technology transfer, and policy development. By developing local expertise in Water Supply and Environmental Engineering, the program reduces reliance on foreign consultants. Additionally, it facilitates the adaptation and transfer of appropriate technologies to address specific national and regional challenges. Furthermore, the program supports evidence-based policymaking, leading to improved water governance and resource allocation.
- **Contributions to National Development:** The program significantly contributes to national development in several key areas. By focusing on the design, construction, and operation of sustainable water supply and sanitation infrastructure, it plays a pivotal role in infrastructure development. Furthermore, the program supports sectors heavily reliant on water supply, such as urban, rural, industrial, thereby boosting sustainable growth. Additionally, by enhancing preparedness and response capabilities for water environment-related disasters, the program effectively contributes to disaster risk reduction.
- **Knowledge Expansion:** The program is dedicated to expanding the frontiers of Water Supply and Environmental Engineering knowledge through cutting-edge research on environmental processes, water quality, and advanced treatment technologies. By fostering interdisciplinary collaboration, it aims

to develop comprehensive solutions to complex water environment related challenges. Additionally, the program emphasizes global knowledge sharing by building international partnerships to exchange best practices and innovations.

By addressing these critical needs and contributing to multiple levels of development, the PhD program in Water Supply and Environmental Engineering is essential for building a sustainable and resilient future.

3. Mission

To cultivate innovative leaders in Water Supply and Environmental Engineering who can develop and implement sustainable solutions to global Water Supply and Environmental Engineering related challenges. Through rigorous research, education, and collaboration, we aim to advance knowledge, protect water resources, and improve the quality of life for communities worldwide.

4. Objectives

The PhD program in Water Supply and Environmental Engineering aims to:

- Develop highly skilled professionals: Equip students with advanced knowledge and expertise in water supply system management, water quality, wastewater treatment, environmental hydrology, and hydraulics.
- Foster innovative research: Encourage original research to address critical water environment related challenges, leading to the development of novel solutions and technologies.
- Promote interdisciplinary collaboration: Cultivate a collaborative research environment that integrates engineering, environmental science, and social sciences to tackle complex water issues.
- Build capacity for sustainable development: Prepare graduates to contribute to the sustainable management of water pollution and the improvement of water quality in developing nations.
- Advance knowledge and practice: Expand the body of knowledge in Water Supply and Environmental Engineering through rigorous research and dissemination of findings.
- Train future leaders: Develop graduates capable of assuming leadership roles in academia, industry, government, and non-profit organizations.
- Address global water challenges: Contribute to the development of sustainable solutions to global water scarcity, pollution, and climate change impacts.
- Promote ethical and responsible engineering: Instill a strong sense of professional ethics and social responsibility among students.

These objectives align with the program's mission to cultivate innovative leaders who can address the pressing water challenges facing the world.

5. Outcome

The successful completion of the PhD program in Water Supply and Environmental Engineering will produce graduates who have:

Knowledge and Skills

- Advanced knowledge: Possess a deep understanding of fundamental principles and advanced concepts in water supply system, hydrology, hydraulics, water quality, sanitary and environmental engineering.
- Research expertise: Capable of conducting independent, original research to address complex Water Supply and Environmental Engineering related challenges.
- Problem-solving abilities: Skilled at applying critical thinking and problem-solving skills to develop innovative solutions to Water Supply and Environmental Engineering issues.

- Communication skills: Effective in communicating complex technical information to both technical and non-technical audiences.
- Leadership skills: Demonstrated ability to lead and collaborate in interdisciplinary research teams.

Career Paths

- Academic careers: Qualified for faculty positions at universities, conducting research and teaching future generations of water professionals.
- Research institutions: Capable of leading research projects in water-related fields, contributing to scientific advancement.
- Government agencies: Equipped to develop and implement water policies, regulations, and management plans.
- Consulting firms: Skilled in providing expert advice on water resources management, water quality, and environmental impact assessment.
- Industry: Able to develop and implement sustainable environment management strategies within organizations.

Societal Impact

- Contribution to sustainable development: Graduates will be equipped to address water scarcity, pollution, and climate change challenges, contributing to a more sustainable future.
- Improved public health: Graduates will contribute to ensuring safe drinking water and sanitation, improving public health outcomes.
- Enhanced environmental protection: Graduates will develop and implement strategies to protect water resources and ecosystems.
- Economic growth: Graduates will contribute to the development of water-related industries and economic growth.

Ultimately, the PhD program aims to produce graduates who are highly skilled, innovative, and ethical leaders capable of making significant contributions to addressing global water challenges.

6. Degree Nomenclature

For the PhD in Water Supply and Environmental Engineering Graduate Program the degree nomenclature should read:

THE DEGREE OF
Doctor of Philosophy in Civil and Environmental Engineering
(Water Supply and Environmental Engineering)
የዶክትሬት ዲግሪ በሲቪል እና አካባቢ ምህንድስና
(በውሃ አቅርቦት እና አካባቢ ምህንድስና)

7. Graduate Profile

The PhD program in Water Supply and Environmental Engineering aims to produce graduates who can assume various roles within the water sector. The graduate profiles are as follows:

Technical Competencies

- Hydrological and Hydraulic Modeling: Proficiency in using advanced modeling tools to simulate water supply systems and predict impacts.
- Water Quality Assessment and Treatment: Expertise in water quality analysis, treatment processes, and emerging contaminants.

- Wastewater Management: Understanding of wastewater collection, treatment, and reuse technologies.
- Environmental Impact Assessment: Ability to assess the environmental impacts of water-related projects.
- Data Analysis and Modeling: Proficiency in statistical and data-driven analysis for informed decision-making.

Interdisciplinary Skills

- Systems Thinking: Understanding the interconnectedness of water systems with other environmental and societal factors.
- Economic Evaluation: Ability to assess the economic viability of water projects.
- Risk Assessment: Capacity to identify and manage water-related risks.
- Climate Change Adaptation: Understanding the impacts of climate change on water resources and developing adaptation strategies.
- Innovation: Ability to develop and implement innovative solutions to water challenges.

Communication and Interpersonal Skills

- Effective Communication: Ability to clearly communicate complex technical information to both technical and non-technical audiences.
- Report Writing: Skill in preparing clear and concise technical reports.
- Public Speaking: Confidence in presenting research findings to diverse audiences.
- Interpersonal Skills: Ability to build and maintain relationships with colleagues, stakeholders, and the public.

Core Research Competencies:

- Research Design: Ability to conceptualize, design, and implement rigorous research projects.
- Data Collection and Analysis: Proficiency in quantitative and qualitative research methods, data analysis techniques, and statistical software.
- Experimental Design: Skill in designing and conducting experiments, including laboratory and field studies.
- Modeling and Simulation: Expertise in developing and applying mathematical and computational models to simulate hydrological, hydraulic, and water quality processes.
- Literature Review: Ability to conduct comprehensive literature reviews to identify knowledge gaps and inform research.
- Research Ethics: Understanding of ethical principles in research and ability to conduct research ethically.

Advanced Research Competencies:

- Interdisciplinary Research: Capacity to collaborate with researchers from different disciplines to address complex water-related problems.
- Innovation: Ability to develop novel research ideas and methodologies.
- Critical Thinking: Skill in evaluating research findings and drawing meaningful conclusions.
- Problem-Solving: Capacity to identify and address research challenges.
- Grant Writing: Ability to secure funding for research projects.
- Publication: Skill in writing and publishing research findings in peer reviewed journals.

8. Teaching and Learning Methodology

A PhD program in Water Supply and Environmental Engineering demands a flexible and research-oriented approach to teaching and learning. The key methodologies include:

Core Methodologies:

- Research-Based Learning: Students are actively involved in research projects from the outset, developing critical thinking, problem-solving, and research skills.
- Seminar and Colloquia: Regular seminars and colloquia by faculty, students, and external experts foster knowledge sharing and critical discussion.
- Independent Study: Students undertake individual research projects under the guidance of faculty, promoting self-directed learning and in-depth exploration of specific topics.
- Dissertation Research: The cornerstone of the program, involving in-depth research, data analysis, and scholarly writing.
- Mentorship: Close faculty-student interactions provide guidance, support, and mentorship throughout the program.

Additional Methodologies:

- Case Studies: Real-world case studies are used to illustrate complex water-related challenges and their solutions.
- Fieldwork: Practical experience through field visits, data collection, and problem-solving in real-world settings.
- Online Learning: Integration of online resources and platforms for access to additional materials and collaborative learning.
- Interdisciplinary Collaboration: Opportunities for collaboration with researchers from other disciplines to foster a holistic perspective.
- Industry Engagement: Partnerships with industry to provide practical experience and exposure to real-world challenges.

By combining these teaching and learning methodologies, the PhD program will effectively equip students with the knowledge, skills, and research capabilities necessary to become leaders in the field of Water Supply and Environmental Engineering.

9. Dissertation Advising Approach

A comprehensive dissertation advising approach for a PhD in Water Supply and Environmental Engineering should be characterized by close collaboration, mentorship, and guidance. The key elements include:

Advisor Selection and Roles

- Faculty Expertise: Advisors should possess deep knowledge and experience in the student's chosen research area.
- Mentorship: Advisors should provide guidance, support, and mentorship throughout the dissertation process.
- Collaboration: Advisors should foster a collaborative environment, encouraging students to interact with other researchers.

Dissertation Committee

- Interdisciplinary Expertise: The committee should comprise faculty members with diverse expertise relevant to the student's research.

- Regular Meetings: Regular committee meetings should be held to monitor progress and provide feedback.
- Comprehensive Evaluation: The committee should provide a rigorous evaluation of the dissertation.

Dissertation Process

- Clear Expectations: Clear guidelines and expectations should be established from the outset.
- Research Proposal Development: Students should develop a comprehensive research proposal with advisor input.
- Regular Progress Reviews: Regular meetings between the student and advisor to track progress and address challenges.
- Writing Support: Advisors should provide guidance on research writing and presentation.
- Dissertation Defense Preparation: Intensive preparation for the dissertation defense.

Additional Considerations

- Student Autonomy: Encouraging students to take ownership of their research while providing guidance.
- Ethical Considerations: Ensuring that research is conducted ethically and in compliance with AAU guidelines.
- Time Management: Helping students develop effective time management strategies.
- Networking Opportunities: Facilitating connections with researchers and professionals in the field.

By following these guidelines, the dissertation advising process can be a valuable experience for both students and advisors, leading to high-quality research and successful completion of the PhD program.

10. Teaching-learning Facilities

A robust PhD program in Water Supply and Environmental Engineering requires a combination of physical infrastructure and technological resources to support research, teaching, and student development.

Physical Infrastructure

- Laboratories:
    - Hydraulics Laboratory: Equipped with hydraulic benches, flow meters, sediment analysis equipment, and rainfall simulators for experimental studies.
    - Water Quality Laboratory: Equipped with instruments for chemical, biological, and microbiological analysis of water and wastewater.
    - Environmental Engineering Laboratory: Facilities for conducting experiments on wastewater treatment, solid waste management, and air pollution control.
    - Surveying Laboratory: Equipped with GIS, remote sensing, and GPS equipment for spatial data analysis and modeling.
- Computer Laboratories: High-performance computers with specialized software for hydrological, hydraulic, water quality, and environmental modeling.
- Library: A comprehensive collection of books, journals, and electronic resources related to Water Supply and Environmental Engineering.
- Seminar Rooms: Spaces for hosting seminars, workshops, and guest lectures.
- Student Study Areas: Quiet spaces for students to study and collaborate.

Technological Infrastructure

- High-Speed Internet: Reliable internet connectivity for accessing online resources, conducting research, and collaborating with researchers worldwide.

- Specialized Software: Access to hydrological, hydraulic, water quality, and environmental modeling software (*e.g.*, HEC-RAS, MIKE SHE, WaterGEMS, MATLAB, GIS, and statistical software).
- Data Management Systems: Infrastructure for storing, managing, and analyzing large datasets.
- Research Equipment: Advanced equipment such as water quality sensors, and field instruments for data collection.
- Online Learning Platforms: Platforms for delivering online courses, hosting virtual seminars, and facilitating student-faculty interactions.

By providing these facilities, the program can effectively support research, teaching, and student development, leading to the production of highly skilled and competent graduates.

11. Assessment Policies and Techniques

The assessment policy ensures that students meet the program's objectives and develop the necessary competencies. It should be aligned with the program's teaching and learning methodologies.

Assessment Policy

- Comprehensive Assessment: The assessment process should evaluate students' knowledge, research skills, critical thinking, and communication abilities.
- Formative and Summative Assessment: Both formative and summative assessments should be employed to provide regular feedback and measure overall performance.
- Transparency: Assessment criteria and procedures should be clearly communicated to students.
- Fairness and Equity: Assessment methods should be fair, equitable, and free from bias.
- Student Involvement: Students should be involved in the assessment process through self and peer assessment.

Assessment Techniques

Given the nature of a PhD program, assessment should focus on the student's ability to conduct independent research, critical thinking, and communication skills.

Coursework Assessment

- Written Assignments: Research proposals, literature reviews, and technical reports.
- Presentations: Oral presentations on research topics and findings.
- Participation: Active participation in seminars, workshops, and group discussions.

Research Assessment

- Research Proposal: Evaluation of the research question, methodology, and feasibility.
- Progress Reports: Regular assessment of research progress, data analysis, and findings.
- Dissertation: Evaluation of the overall research contribution, originality, and methodology.
- Dissertation Defense: Oral defense of the dissertation, demonstrating comprehensive knowledge and research capabilities.

Other Assessment Techniques

- Peer Review: Evaluation of student work by peers to develop critical thinking and communication skills.
- Self-Assessment: Students reflecting on their learning and progress to foster self-awareness.
- Portfolio Assessment: A collection of student work to demonstrate growth and development over time.

By implementing a comprehensive assessment policy and utilizing a variety of assessment techniques, the PhD program can effectively monitor student progress, identify areas for improvement, and ensure the development of highly qualified graduates.

12. Grading

Student evaluation will adhere to articles 114.1 and 114.2 of the Senate legislation concerning examinations and theses, respectively. The grading for examinations will utilize the following letter grading system, which is associated with specific point values.

Raw Mark	Letter Grade	Grade Points
[95, 100)	A+	4.00
[85, 95)	A	4.00
[80, 85)	A–	3.75
[75, 80)	B+	3.50
[70, 75)	B	3.00
[65, 70)	B–	2.75
[60, 65)	C+	2.50
[50, 60)	C	2.00
[40, 50)	D	1.00
< 40	F	0.00

The evaluation of dissertations will be conducted using the following ranking system, which includes specific grading scales and corresponding letter grades.

Rank	Grading scale in percent	Letter Grade
Excellent	≥ 85	A
Very Good	75 ≤ X < 85	B+
Good	60 ≤ X < 75	B
Satisfactory	50 ≤ X < 60	C+
Fail	< 50	F

13. Admission Requirements

The admission requirements for applicants encompass both general and specific requirements, which are outlined as follows.

General:

- The Graduate Admission Test: The candidate is required to successfully complete the graduate aptitude test administered by the university or another pertinent governmental body, such as the ministry of education, in order to evaluate their verbal, quantitative, and analytical reasoning skills as indicators of potential success in graduate studies.
- Letters of recommendation: Letters from academic or professional references can be requested.
- Statement of purpose: A written statement outlining the applicant's academic and career goals can be requested.
- Curriculum Vitae: A detailed resume highlighting academic and professional experience can be requested.

Specific Requirements

- Master of Science degree: In a relevant field such as water supply engineering, environmental engineering, hydraulic engineering, water Resources Engineering, or a closely related discipline.
- Entrance Examination: Candidates are required to successfully complete an entrance examination designed by the SCEE to evaluate their particular qualifications for the program.
- Minimum GPA: minimum Grade Point Average (GPA) of 3.0.
- Relevant concept note: Specific concept note in subjects related to water supply, sanitation, hydrology, hydraulics, environmental science.

14. Duration of the Program

The duration for the completion of a PhD's program shall range from a minimum of 36 months to a maximum of 48 months. Any extension of the duration beyond this limit is expected to be administered according to the rules and regulations of the AAU Senate.

15. Graduation Requirements

Continuous registration is required at the home institution or the partner institution abroad in the beginning of each semester. A candidate who fails to maintain a continuous registration without officially withdrawing from the program will be considered to have dropped out.

Course Work

The minimum total European Credit Transfer and Accumulation System (ECTS) required for coursework is set at 30. Candidates holding an MSc in related disciplines may be mandated to complete additional credit hours based on the recommendations of their Advisory Committee, although the total shall not surpass 120, in accordance with AAU Senate legislation article 111.5. This requirement must receive approval from both the SCEE graduate committee (SGC) and the SCEE Academic Council (SAC) of the School. If deemed necessary, candidates may also be required to enroll in prerequisite graduate courses in Civil and Environmental Engineering, with the expectation of attaining a cumulative average grade of "B."

A selection of course lists is provided for specializations in Water Supply and Environmental Engineering. In collaboration with the Advisory Committee, the candidate will select at least three elective courses and two mandatory seminars pertinent to their specialization and research requirements to meet the minimum ECTS requirements for coursework. To enhance the diversity of their PhD research, students are also permitted to enroll in courses from other accredited academic institutions (both national and international), contingent upon the recommendation of the Advisory Committee.

Research Work

All PhD candidates are expected to carry out original research in their field of specialization, the result of which is presented as a doctoral dissertation subject to careful scrutiny by internal and external examiners as per the university regulation. According to AAU Senate legislation (article 119.1.2) for graduation, a PhD candidate shall produce two articles in reputable journal or an article in reputable journal and peer reviewed conference papers in addition to his dissertation.

16. Quality Assurance

To maintain and enhance the quality of the PhD in Water Supply and Environmental Engineering program, a robust monitoring and evaluation system is shown below. This system is designed to collect data on various aspects of the program and use it to inform decision-making and continuous improvement.

The program quality assurance strategy involves three approaches viz. input, process and output monitoring. Input monitoring focuses on tracking the resources allocated to the program, such as faculty, staff, facilities, equipment, and financial support, to ensure adequate provisions. Process monitoring delves into the program's implementation, assessing curriculum delivery methods, teaching strategies, and student support services to evaluate their effectiveness in achieving program goals. Output monitoring measures the immediate outcomes of program activities, including student enrollment, graduation rates, and thesis completion, to assess the program's efficiency and productivity. By combining these monitoring strategies, program administrators can gain valuable insights into the program's performance and identify areas for improvement.

Evaluation methods for the program quality assurance encompass Student Satisfaction Surveys, Graduate Tracer Studies, Employer Surveys, Curriculum Review, Faculty Evaluation, Program Outcome Assessment

and Benchmarking to assess program effectiveness and identify areas for improvement. Student satisfaction surveys provide invaluable insights into the educational experience, capturing perceptions of teaching quality, curriculum relevance, facilities, and overall program satisfaction. Graduate tracer studies offer a longitudinal perspective, tracking alumni career trajectories to measure program outcomes and impact on professional success. Employer surveys supplement this by gathering feedback on graduate preparedness and skill alignment with industry demands. Curriculum review ensures ongoing relevance by aligning program content with evolving academic standards and industry needs. Faculty evaluation, through student feedback, peer assessment, and research productivity, supports continuous improvement in teaching and scholarship. Program outcome assessment measures the extent to which students achieve stated learning objectives, while benchmarking against peer institutions provides external validation and identifies opportunities for enhancement.

Data collection methods will employ a mixed method approach to comprehensively assess the program. The collection method involve surveys and questionnaires, interviews, focus groups, document analysis and performance indicators**.** Surveys and questionnaires quantified student, faculty, staff, and employer perspectives, providing numerical data on program strengths and weaknesses. In-depth interviews with key stakeholders offered rich qualitative insights into program experiences and challenges. Focus groups facilitated collective exploration of specific program aspects, capturing shared opinions and diverse viewpoints. Document analysis of course syllabi, student records, and reports provided contextual understanding of program design and implementation. Finally, performance indicators were utilized to track program outcomes over time, offering quantitative benchmarks for evaluation and improvement.

Data analysis and reporting are crucial components of program quality assurance. Descriptive, and comparative analysis together with impact analysis and regular reporting will be conducted based on the data collected. Descriptive analysis involves summarizing data to uncover trends and patterns, providing a foundational understanding of program performance. Comparative analysis places program outcomes in context by benchmarking against industry standards or historical data, enabling identification of strengths, weaknesses, and areas for improvement. Impact analysis delves deeper, assessing the program's contribution to student learning outcomes and career success, ultimately demonstrating its value and effectiveness. Regular reporting ensures that stakeholders are informed about program progress, challenges, and successes, fostering transparency, accountability, and informed decision-making.

17. Teaching Staff

The subsequent list of personnel is available to facilitate the delivery of the MSc program.

No.	Name	Qualification	Specialization
1	Agizew Niguse	Assoc. Prof.	Hydrology and Environmental Engineering
2	Asnake Teshome	Chief Lab Technician	Water quality and sanitary engineering
3	Ethiopia Bisrat	Lecturer	Civil and Environmental Engineering
4	Fiseha Behulu	Assist. Prof.	Water distribution modelling
5	Geremew Sahilu	Assoc. Prof.	Civil and Environmental Engineering
6	Jhony Girma	Assist. Prof.	Civil and Environmental Engineering (Water supply and Environmental Engineering)
7	Kehali	Senior Lab Technician	Water quality and sanitary engineering
8	Mahlet Melaku	Lecturer	Civil and Environmental Engineering
9	Mebruk Mohammed	Assoc. Prof.	Civil and Environmental Engineering
10	Zerihun Getaneh	Assist. Prof.	Civil and Environmental Engineering (Water supply and Environmental Engineering)

18. Module and Course Coding

Modules are designated with the prefix "CENG" which represents the name of the school appended by–M and followed by a four-digit numerical code:

- The initial digit signifies the module level corresponding to the academic year, with 8 and 9 representing the respective first and second year of the program.
- The second digit denotes the specific streams or programs within the Civil and Environmental school, where 6 is assigned to water-related programs.
- The final two digits serve as a serial number for the modules within the PhD program.

Courses are designated with the prefix "CENG" which represents the name of the school, followed by a four-digit numerical code:

- The initial digit signifies the course level corresponding to the academic year, with 8 and 9 representing the respective first and second year of the program.
- The second digit denotes the specific streams or programs within the Civil and Environmental school, where 6 is assigned to water-related programs.
- The final two digits serve as a serial number for the courses within the PhD program.

19. Module List

This program has three modules Seminar, elective, and research modules as shown below. Dividing a PhD program into seminar, elective, and research modules offers a structured framework for doctoral students. The seminar module provides a foundational base through compulsory coursework in research methodology, advanced topics, and ethics. Elective modules offer flexibility for students to specialize based on their research interests. The core of the program lies in the research module, dedicated to independent research culminating in a doctoral dissertation.

Code	**Title**
CENG-M 8601	**Seminar module**
CENG 8632	Seminar-I
CENG 8633	Seminar-II
CENG-M 8602	**Elective module**
CENG 8606	Advanced Research Methods
CENG 8613	Water Quality Modeling
CENG 8614	Environmental Chemistry
CENG 8615	Principles of Environmental Modeling
CENG 8616	Eco-hydrology and Ecosystem modeling
CENG 8617	Pollutant fate and transport in the water environment
CENG 8618	Advanced Urban Drainage System Engineering
CENG 8631	Sustainable water supply systems
****** ####**	Open Elective course[+]
CENG-M 9900	**Research module**
CENG 9900	Dissertation
[+]A PhD student is permitted to enroll in any pertinent PhD course offered by the graduate programs at AAU or national or international academic institution, contingent upon the approval of the SGC and SAC.	

20. Modular Structure

Below is a summary table that categorizes modules into basic, core, elective, and research categories, detailing the competencies and their associated objectives.

Module Name	Competencies	Objectives
CENG-M8601 Seminar Modules	• Critical thinking and analysis: Students develop the ability to critically evaluate research, identify gaps in knowledge, and formulate research questions. • Oral communication skills: Effective presentation of complex ideas, engaging with an audience, and handling questions are essential competencies. • Written communication skills: Developing the ability to articulate research findings clearly and concisely in written form. • Research methodology: Understanding various research methodologies and their application to specific research questions. • Interpersonal skills: Effective collaboration, teamwork, and participation in academic discussions. • Time management and organization: Efficient preparation and delivery of seminar presentations.	• Knowledge sharing: Disseminating research findings and ideas among peers and faculty. • Feedback and critique: Providing constructive feedback on the work of others and receiving feedback on one's own work. • Academic discourse: Engaging in intellectual discussions and debates on relevant topics. • Research development: Refining research ideas and methodologies through peer review and feedback. • Professional development: Enhancing presentation and communication skills. • Networking: Building relationships with peers and faculty within and outside the program.
CENG-M8602 Elective Modules	• Advanced knowledge: Deep understanding of specific areas within Water Supply and Environmental Engineering. • Research methodology: Proficiency in conducting independent research, data analysis, and interpretation. • Problem-solving: Ability to identify, analyze, and develop innovative solutions to complex water and environmental challenges. • Communication: Effective communication of technical information to both technical and non-technical audiences. • Collaboration: Ability to work effectively in interdisciplinary teams.	• Specialization: Providing in-depth knowledge of specific water or environmental engineering topics. • Research skills: Enhancing research methodologies applicable to the chosen specialization. • Innovation: Fostering the development of new ideas and technologies. • Problem-solving: Applying advanced knowledge to address real-world water and environmental issues. • Interdisciplinary integration: Connecting water and environmental engineering with other fields (*e.g.*, hydrology, ecology, economics).
CENG-M 9900 Research Module	• Advanced knowledge of water resources engineering principles: Hydrology, hydraulics, water quality, and water treatment processes.	• Formulate a research question and develop a research plan.

	• Strong foundation in environmental engineering: Solid & Sanitary Waste management, air pollution, and environmental impact assessment. • Proficiency in research methodologies: Experimental design, data analysis, statistical modeling, and scientific writing. • Ability to conduct independent research: Identifying research gaps, formulating research questions, and developing research methodologies. • Critical thinking and problem-solving skills: Analyzing complex water and environmental challenges and proposing innovative solutions.	• Conduct literature review to identify knowledge gaps and research opportunities. • Collect, analyze, and interpret data to address the research question. • Effectively communicate research findings through written and oral presentations. • Contribute to the advancement of knowledge in the field of Water Supply and Environmental Engineering.

21. Courses within Modules

The table below presents clusters of courses organized into modules, including course codes, titles, and ECTS. For each course, the allocated hours for lectures, tutorials, laboratory work, and independent study are specified, along with the total ECTS for the module. It is important to note that no courses are scheduled in a sequential manner; rather, all courses can be taken concurrently.

Number	Course Title	ECTS	Lec	Lab/Field	Indep. Study
CENG-M 8601	**Seminar module**	**12**	**0**	**0**	**12**
CENG 8632	Seminar-I	6	0	0	6
CENG 8633	Seminar-II	6	0	0	6
CENG-M 8602	**Elective module**	**18**			
CENG 8606	Advanced Research Methods	6	2	0	4
CENG 8613	Water Quality Modelling	6	2	1	3
CENG 8614	Environmental Chemistry	6	1	2	3
CENG 8615	Principles of Environmental Modeling	6	2	1	3
CENG 8616	Eco-hydrology and Ecosystem modeling	6	2	1	3
CENG 8617	Pollutant fate and transport in the water environment	6	2	1	3
CENG 8618	Advanced Urban Drainage System Engineering	6	2	1	3
CENG 8631	Sustainable water supply systems	6	2	1	3
****** ####**	Open Elective course*	-			
CENG-M 9900	**Research module**	**120**			**120**
CENG 9900	Dissertation	120			120
+A PhD student is permitted to enroll in any pertinent PhD course offered by the graduate programs at AAU or national or international academic institution, contingent upon the approval of the SGC and SAC.					

22. Semester Course Breakdown

The following tables outlines the sequencing and scheduling of courses by semester and year, incorporating the ECTS. Additionally, it details the time allocated for lectures, field/laboratories, and independent study.

Year I, Semester I					
Code	**Course Title**	**ECTS**	**Lec**	**Lab/Field**	**Indep. Study**
	Elective 1	6			
	Elective 2	6			
CENG 8632	Seminar-I	6			6
	Total	**18**			

Year I, Semester II					
Code	**Course Title**	**ECTS**	**Lec**	**Lab/Field**	**Indep. Study**
	Elective 3	6			
CENG 8633	Seminar-II	6			6
	Total	**12**			

Year II and above for both semesters					
Code	**Course Title**	**ECTS**	**Lec**	**Lab/Field**	**Indep. Study**
CENG 9900	Dissertation	120			120
	Total	**120**			**120**

23. Module Handbook

CENG-M 8601 Seminar Module

Number	**Course Title**	**ECTS**	**Lec**	**Lab/Field**	**Indep. Study**
CENG-M 8601	**Seminar module**	**12**	**0**	**0**	**12**
CENG 8632	Seminar-I	6	0	0	6
CENG 8633	Seminar-II	6	0	0	6

Module description: The seminar module in a Water Supply and Environmental Engineering PhD program is designed to provide students with a strong foundation in advanced research methodologies and contemporary issues within the field. This module aims to equip students with the necessary tools and knowledge to conduct independent research, critically evaluate existing literature, and effectively communicate their findings to both academic and professional audiences. It typically includes two series of compulsory seminars that cover advanced Topics in Water Supply and Environmental Engineering. In-depth exploration of specialized areas within the field, such as water quality modeling, solid waste management, sanitation, hydraulics, wastewater treatment, environmental impact assessment, and climate change adaptation in water resources, etc. is expected.

Module Competencies

- Critical thinking and analysis: Students develop the ability to critically evaluate research, identify gaps in knowledge, and formulate research questions.
- Oral communication skills: Effective presentation of complex ideas, engaging with an audience, and handling questions are essential competencies.

- Written communication skills: Developing the ability to articulate research findings clearly and concisely in written form.
- Research methodology: Understanding various research methodologies and their application to specific research questions.
- Interpersonal skills: Effective collaboration, teamwork, and participation in academic discussions.
- Time management and organization: Efficient preparation and delivery of seminar presentations

Module Objectives

- Knowledge sharing: Disseminating research findings and ideas among peers and faculty.
- Feedback and critique: Providing constructive feedback on the work of others and receiving feedback on one's own work.
- Academic discourse: Engaging in intellectual discussions and debates on relevant topics.
- Research development: Refining research ideas and methodologies through peer review and feedback.
- Professional development: Enhancing presentation and communication skills.
- Networking: Building relationships with peers and faculty within and outside the program.

Module Delivery: The seminar module can be delivered through a combination of face-to-face and online methods. This flexibility allows for interactive discussions, hands-on activities, and the opportunity to leverage online resources.

Module Duration: The seminar module typically spans two semesters.

Teaching-Learning Methods: A variety of teaching-learning methods can be employed to enhance student engagement and knowledge acquisition. These include:

- **Seminars:** To foster critical thinking, discussion, and peer-to-peer learning through presentations and debates.
- **Workshops:** To develop practical skills in research methodologies, data analysis, and scientific writing.
- **Online learning platforms:** To facilitate access to supplementary materials, online resources, and collaborative learning.
- **Guest lectures:** To expose students to diverse perspectives and industry practices.

Assessment Approach: Assessment should be aligned with the learning outcomes of the seminar module. A combination of formative and summative assessments can be used to evaluate student performance:

- **Formative assessments:**
  - Participation in class discussions and seminars
  - Assignments and presentations
  - Peer reviews of research proposals
- **Summative assessments:**
  - Comprehensive research proposal
  - Literature review

CENG-M 8602 Elective module

Number	Course Title	ECTS	Lec	Lab/Field	Indep. Study
CENG-M 8602	**Elective module**	**18**			
CENG 8606	Advanced Research Methods	6	2	0	4

CENG 8613	Water Quality Modelling	6	2	1	3
CENG 8614	Environmental Chemistry	6	1	2	3
CENG 8615	Principles of Environmental Modeling	6	2	1	3
CENG 8616	Eco-hydrology and Ecosystem modeling	6	2	1	3
CENG 8617	Pollutant fate and transport in the water environment	6	2	1	3
CENG 8618	Advanced Urban Drainage System Engineering	6	2	1	3
CENG 8631	Sustainable water supply systems	6	2	1	3
****** ####**	Open Elective course[+]	-			
[+]A PhD student is permitted to enroll in any pertinent PhD course offered by the graduate programs at AAU or national or international academic institution, contingent upon the approval of the SGC and SAC.					

Module Description

The elective courses module offers PhD students the opportunity to deepen their knowledge and expertise in specific areas of Water Supply and Environmental Engineering. Courses are designed to supplement the core curriculum and provide students with the flexibility to tailor their studies to their research interests and career goals.

Competencies

- Advanced knowledge: Deep understanding of specific areas within Water Supply and Environmental Engineering.
- Research methodology: Proficiency in conducting independent research, data analysis, and interpretation.
- Problem-solving: Ability to identify, analyze, and develop innovative solutions to complex water and environmental challenges.
- Communication: Effective communication of technical information to both technical and non-technical audiences.
- Collaboration: Ability to work effectively in interdisciplinary teams

Objectives

- Specialization: Providing in-depth knowledge of specific water or environmental engineering topics.
- Research skills: Enhancing research methodologies applicable to the chosen specialization.
- Innovation: Fostering the development of new ideas and technologies.
- Problem-solving: Applying advanced knowledge to address real-world water and environmental issues.
- Interdisciplinary integration: Connecting water and environmental engineering with other fields (*e.g.*, hydrology, ecology, and economics).

Module Delivery

Elective courses can be delivered through a variety of methods, including:

- Lectures: Formal presentations by faculty experts on specific topics.
- Seminars: Interactive discussions and presentations by faculty and guest speakers.
- Workshops: Hands-on training and skill development sessions.
- Online learning: Flexible access to course materials and interactive online platforms.

- Fieldwork: Practical experience through site visits and data collection.

Module Duration

Elective courses can vary in duration, typically ranging from five to seven ECTS or equivalent. The minimum total number of elective credits required for this PhD program is 18 ECTS.

Teaching-Learning Methods

A combination of teaching and learning methods can be employed to enhance student engagement and learning:

- Lectures and seminars: To impart theoretical knowledge and stimulate critical thinking.
- Group discussions and debates: To foster collaboration and problem-solving skills.
- Case studies and problem-based learning: To apply theoretical knowledge to real-world scenarios.
- Independent research and projects: To develop research skills and encourage self-directed learning.
- Guest lectures and industry visits: To expose students to current trends and industry practices.

Assessment Approach

Assessment methods for elective courses should align with the course objectives and competencies. Possible assessment approaches include:

- Written assignments: Essays, reports, or research papers to evaluate knowledge and critical thinking.
- Presentations: Oral presentations to assess communication and presentation skills.
- Projects: Individual or group projects to evaluate problem-solving and practical application of knowledge.
- Exams: To assess theoretical understanding and knowledge retention.
- Portfolios: To demonstrate overall learning and development.

CENG-M 9900: Research module

Number	Course Title	ECTS	Lec	Lab/Field	Indep. Study
CENG-M 9900	**Research module**	**120**	**0**	**0**	**120**
CENG 9900	Dissertation	120	0	0	120

Module Description

The research module constitutes the core of the PhD program in Water Supply and Environmental Engineering. It is designed to cultivate independent research capabilities, critical thinking, and problem-solving skills. Students will conceptualize, design, execute, and disseminate original research contributing to the advancement of knowledge in the field.

Competencies

- Advanced knowledge of water resources engineering principles: Hydrology, hydraulics, water quality, and water treatment processes.
- Strong foundation in environmental engineering: Solid & Sanitary Waste management, air pollution, and environmental impact assessment.
- Proficiency in research methodologies: Experimental design, data analysis, statistical modeling, and scientific writing.
- Ability to conduct independent research: Identifying research gaps, formulating research questions, and developing research methodologies.

- Critical thinking and problem-solving skills: Analyzing complex water and environmental challenges and proposing innovative solutions.

Objectives

- Formulate a research question and develop a research plan.
- Conduct literature review to identify knowledge gaps and research opportunities.
- Collect, analyze, and interpret data to address the research question.
- Effectively communicate research findings through written and oral presentations.
- Contribute to the advancement of knowledge in the field of Water Supply and Environmental Engineering.

Module Delivery

The research module is primarily delivered through a one-on-one supervisory relationship between the student and a faculty advisor. Regular meetings, progress reviews, and research seminars provide opportunities for feedback, guidance, and collaboration. Additionally, the student may participate in research group meetings, conferences, and workshops to enhance their research skills and network with peers and experts.

Module Duration

The duration of the research module typically spans three to four years, depending on the complexity of the research project and the AAU's regulations. It is a full-time commitment requiring dedicated effort from the student.

Teaching-Learning Methods

- One-on-one supervision: Regular meetings with the advisor to discuss research progress, challenges, and strategies.
- Research presentations: Opportunities to present research findings to peers, faculty, and external experts.
- Literature review and critical analysis: Extensive engagement with relevant research literature to develop a strong theoretical foundation.
- Data collection and analysis: Application of appropriate research methodologies and statistical techniques.
- Research proposal development: Formulation of a clear and comprehensive research proposal outlining research objectives, methodology, and expected outcomes.
- Dissertation writing: Development of a well-structured and coherent dissertation that effectively communicates research findings.

Assessment Approach

The research module is primarily assessed through the completion of published articles and a doctoral dissertation. The dissertation is evaluated based on its originality, contribution to knowledge, research methodology, data analysis, clarity of presentation, and adherence to academic standards. Additional assessments may include progress reports, research proposals, and oral defenses.

24. Course Guide Books

CENG 8606: Advanced Research Methods

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Advanced Research Methods

N	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Elective
2	Core competencies Students will be able to:	• Design and implement comprehensive research projects • Critically evaluate research methodologies and data • Apply advanced statistical and data analysis techniques • Communicate research findings effectively • Adhere to ethical principles in research
3	Course Type	Elective
4	Course Identifiers	
	4.1. Course Code	CENG 8606
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office and Office Hrs	 - - -
8	Course Description	This course is designed to equip PhD students in Water Supply and Environmental Engineering with advanced research methodologies and skills necessary to conduct independent and rigorous research. The course will focus on the application of qualitative and quantitative research approaches, data analysis techniques, and research ethics in the context of water-related challenges.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes Students will be able to:	• Develop a deep understanding of research paradigms and philosophies • Master advanced research design and data collection methods • Be proficient in using statistical software for data analysis • Gain experience in writing research proposals and manuscripts • Develop critical thinking and problem-solving skills for research

12	Course Contents	• Research Philosophy and Design:
		  ○ Research paradigms (positivism, interpretivism, constructivism)
		  ○ Research designs (experimental, correlational, causal-comparative, descriptive)
		  ○ Research questions and hypotheses
		• Data Collection Methods:
		  ○ Qualitative research methods (interviews, focus groups, observation)
		  ○ Quantitative research methods (surveys, experiments, secondary data analysis)
		  ○ Mixed methods research
		• Data Analysis:
		  ○ Advanced statistical techniques (regression, ANOVA, factor analysis, structural equation modeling)
		  ○ Qualitative data analysis (thematic analysis, content analysis)
		  ○ Data visualization and presentation
		• Research Ethics:
		  ○ Ethical principles in research
		  ○ Research integrity and misconduct
		  ○ Data management and privacy
		• Research Proposal and Dissemination:
		  ○ Writing research proposals
		  ○ Scientific writing and publication
		  ○ Research presentation and communication

13	Teaching and learning techniques	• Lectures: Theoretical concepts and research methodologies • Group discussions: Critical analysis of research studies • Practical exercises: Data analysis and interpretation • Research proposal development: Individual or group projects • Guest lectures: Experts in research methods and specific research areas
14	Assessments	• Assignments: Research design, literature review, data analysis • Research proposal: Development of a comprehensive research proposal • Mock Research paper: Writing and submission of a research paper • Presentations: Oral presentation of research findings • Participation: Active engagement in class discussions and activities
15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	• Textbooks on research methods, statistics, and research ethics
	16.2. References	• Academic journals in Water Supply and Environmental Engineering • Research databases (*e.g.,* Scopus, Web of Science)
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Tech.	• Statistical software (*e.g.,* SPSS, R, STATA) • Online resources for research methods and data analysis
17	Assessment rubrics	• Assignments, research project evaluation, class participation: 50% • Mock research Paper: 50%

CENG 8613: Water Quality Modeling

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Water Quality Modelling

No	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Elective
2	Core competencies Students will be able to:	• Conceptualize water quality problems as complex systems involving multiple interacting processes. • Develop appropriate mathematical models to represent water quality dynamics. • Apply computational tools to simulate and analyze water quality scenarios. • Evaluate model performance and uncertainties. • Communicate modeling results effectively to inform decision-making.
3	Course Type	Elective
4	Course Identifiers	
	4.1. Course Code	CENG 8613
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office and Office Hrs	 - - -
8	Course Description	This course provides a comprehensive understanding of water quality modeling principles and their application in assessing and managing water resources systems. Students will develop the ability to simulate, analyze, and predict water quality conditions in various aquatic environments, considering physical, chemical, and biological processes. The course emphasizes the role of modeling in supporting informed decision-making for water quality management and pollution control strategies.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes Students will be able to:	• Understand the fundamental concepts and principles of water quality modeling.

		• Master various water quality modeling techniques and their applications. • Develop critical thinking and problem-solving skills in addressing water quality challenges. • Be proficient in using water quality modeling software and tools. • Gain experience in conducting independent research and analysis.
12	Course Contents	• Introduction to Water Quality Modeling: o Water quality parameters and standards o Water quality issues and challenges o Modeling concepts and approaches o Model development process (conceptualization, calibration, validation) o Model uncertainty and sensitivity analysis • Hydrological and Hydraulic Modeling: o Hydrological processes and water balance o Hydraulic modeling for rivers, lakes, and estuaries o Coupling hydrological and water quality models • Water Quality Processes: o Physical, chemical, and biological processes affecting water quality o Nutrient cycling and eutrophication o Contaminant transport and fate o Water quality indicators and assessment • Water Quality Modeling Applications: o River water quality modeling o Lake and reservoir water quality modeling o Estuary and coastal water quality modeling o Groundwater quality modeling o Drinking water treatment and distribution modeling • Advanced Topics: o Integrated water quality and ecological modeling o Decision support systems for water quality management o Data-driven modeling and machine learning applications
13	Teaching and learning techniques	• Lectures: Formal presentations on specific topics. • Seminars: Interactive discussions and presentations by faculty and guest speakers. • Problem-solving sessions: Application of modeling techniques to practical problems • Online learning: Flexible access to course materials and interactive online platforms.
14	Assessments	• Assignments: Homework problems and case studies • Final exam: To assess understanding of core concepts and Comprehensive evaluation of knowledge and problem-solving skills • Research paper or project: To apply course concepts to a real-world problem and demonstrate independent research abilities • Presentations: Communication of modeling results • Class participation: To encourage active engagement and critical thinking

15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	• Textbooks on water quality modeling, hydrology, and hydraulics • Peer reviewed journal articles • Water quality modeling software (*e.g.*, QUAL2K, MIKE 11, SWAT, EFDC) • Online databases and repositories of water quality data • Case studies and real-world examples
	16.1.Textbooks	-
	16.2. References	•
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Technology	-
17	Assessment rubrics	• Assignments, research project evaluation, class participation: 50% • Final Exam: 50%

CENG 8614: Environmental Chemistry

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Environmental Chemistry

No	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Elective
2	Core competencies Students will be able to:	• Apply advanced chemical principles to environmental systems. • Analyze the chemical composition and properties of natural waters. • Evaluate the efficacy of water treatment and remediation technologies. • Develop and implement innovative solutions to water quality challenge
3	Course Type	Elective
4	Course Identifiers	
	4.1. Course Code	CENG 8614
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office & Office Hrs	- - -
8	Course Description	This course provides an in-depth exploration of the chemical principles governing environmental systems, with a particular emphasis on aquatic environments. Students will develop a comprehensive understanding of the behavior, fate, and transport of pollutants in water, as well as the chemical processes underlying water treatment and remediation. The course integrates theoretical knowledge with practical applications, preparing students for advanced research in Water Supply and Environmental Engineering.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes Students will be able to:	• Understand the fundamental principles of aquatic chemistry. • Master advanced analytical techniques for water quality assessment. • Develop a critical understanding of the impact of pollutants. • Be proficient in designing and conducting water quality experiments. • Gain expertise in developing and evaluating water treatment and remediation strategies.
12	Course Contents	• Aquatic Chemistry Fundamentals: o Acid-base equilibria, redox reactions, complexation, and precipitation in aquatic systems.

		○ Chemical speciation and bioavailability of elements. ○ Organic matter in natural waters and its role in pollutant fate. • Water Treatment and Remediation: ○ Conventional and advanced water treatment processes. ○ Removal of organic and inorganic contaminants. ○ Disinfection and waterborne pathogens. ○ Remediation of contaminated water bodies. • Emerging Contaminants: ○ Pharmaceuticals, personal care products. ○ Nanomaterials and their environmental impact. ○ Emerging analytical techniques for contaminant analysis.
13	Teaching and learning techniques	• Lectures: Formal presentations on specific topics. • Seminars: Interactive discussions and presentations by faculty and guest speakers. • Laboratory experiments: Hands-on experience with water analysis and treatment • Problem-solving sessions: Application of modeling techniques to practical problems • Online learning: Flexible access to course materials and interactive online platforms.
14	Assessments	• Assignments: Homework problems, case studies, laboratory reports • Final exam: To assess understanding of core concepts and Comprehensive evaluation of knowledge and problem-solving skills • Research paper or project: To apply course concepts to a real-world problem and demonstrate independent research abilities • Presentations: Communication of laboratory/study results • Class participation: To encourage engagement and critical thinking
15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	-
	16.2. References	• CRC Press, 2010, Environmental Chemistry, J SE Manahan, 9th edition, New York • W.H. Freeman press, Environmental Chemistry, C Baird, New York • Oxford University press, 2005, Environmental Chemistry: a global perspective, TW van Loon, SJ Duffy, • T.F. Yen, Environmental Chemistry, Vol. 4B: Chemical Principles for Environmental Processes, Prentice Hall, 1999:
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Tech.	-
17	Assessment rubrics	• Assignments, research/laboratory project evaluation, class participation: 50% • Final Exam: 50%

CENG 8615: Principles of Environmental Modeling

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Principles of Environmental Modelling

No	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Elective
2	Core competencies Students will be able to:	• Conceptualize environmental problems as complex systems involving physical, chemical, and biological interactions. • Develop appropriate mathematical models to represent environmental processes. • Apply computational tools to simulate and analyze environmental systems. • Evaluate model performance and uncertainties. • Communicate modeling results effectively to diverse audiences.
3	Course Type	Elective
4	Course Identifiers	
	4.1. Course Code	CENG 8615
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office and Office Hrs	 - - -
8	Course Description	This course provides a comprehensive understanding of environmental modeling principles and their application in natural environmental systems. Students will develop the ability to investigate, understand, and predict the current and future state of the natural environment through quantitative modeling techniques. The course emphasizes the role of modeling in environmental decision-making and management strategies.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes Students will be able to:	• Understand the fundamental concepts and principles of environmental modeling. • Master various modeling techniques and their applications in water resources and environmental engineering.

		• Develop critical thinking and problem-solving skills in addressing environmental challenges. • Be proficient in using a modeling software and tools. • Gain experience in conducting independent research and analysis.

12	Course Contents	• Introduction to Environmental Modeling:
		  o Definition and scope of environmental modeling
		• Types of environmental models (deterministic, stochastic, empirical, mechanistic)
		• Model development process (conceptualization, formulation, calibration, validation)
		• Model uncertainty and sensitivity analysis
		• Environmental Impact Assessment Modeling:
		  o Environmental impact assessment (EIA) process
		  o Modeling tools for EIA
		  o Case studies of EIA modeling applications
		• Advanced Modeling Topics:
		  o Integrated modeling (coupling hydrological, water quality, and ecological models)
		  o Decision support systems
		  o Data-driven modeling (machine learning, artificial intelligence)

13	Teaching and learning techniques	• Lectures: Formal presentations on specific topics. • Seminars: Interactive discussions and presentations by faculty and guest speakers. • Problem-solving sessions: Application of modeling techniques to practical problems • Online learning: Flexible access to course materials and interactive online platforms.
14	Assessments	• Assignments: Homework problems and case studies • Final exam: To assess understanding of core concepts and Comprehensive evaluation of knowledge and problem-solving skills • Research paper or project: To apply course concepts to a real-world problem and demonstrate independent research abilities • Presentations: Communication of modeling results • Class participation: To encourage active engagement and critical thinking
15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	-
	16.2. References	• J. Wiley, 2005, Integrated Environmental Modelling, Hoboken, NJ, • CRC Press, 2019, Environmental Modeling: A Practical Introduction 1st Edition, Mike J. Barnsley • ISLAND Press, 2009, Modeling the Environment, Second Edition by Andrew Ford,
	16.3. Lab Materials and Equipment	-

	16.4. Website, ICT and Digital Tech.	-
17	Assessment rubrics	• Assignments, research project evaluation, class participation: 50% • Final Exam: 50%

CENG 8616: Eco-hydrology and Ecosystem Modeling

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Eco-hydrology and Ecosystem Modelling

No	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Elective
2	Core competencies Students will be able to:	• Comprehend the fundamental principles of eco-hydrology and their application to water resource management. • Develop and apply quantitative models to simulate hydrological and ecological processes. • Analyze the impacts of climate change, land use change, and other stressors on ecosystem services. • Evaluate the effectiveness of management strategies for water resources and ecosystem conservation. • Communicate complex eco-hydrological concepts and modeling results to diverse audiences.
3	Course Type	Elective
4	Course Identifiers	
	4.1. Course Code	CENG 8616
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office and Office Hrs	 - - -
8	Course Description	This course delves into the intricate interactions between hydrological processes and ecological systems. Students will explore the fundamental principles of eco-hydrology, developing a deep understanding of how water availability influences ecosystem structure, function, and services. The course emphasizes the application of modeling techniques to simulate and predict ecosystem responses to hydrological changes, climate variability, and human disturbances.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes	• Develop a strong foundation in eco-hydrological theory and concepts.

	Students will be able to:	• Master a range of modeling techniques for simulating hydrological and ecological processes. • Gain proficiency in data analysis and interpretation for eco-hydrological studies. • Understand the role of eco-hydrology in water resources management and ecosystem conservation. • Develop critical thinking and problem-solving skills to address complex environmental challenges..
12	Course Contents	• Introduction to Eco-hydrology: o Core concepts and principles of eco-hydrology o Hydrological processes and their ecological implications o Ecosystem structure and function o Ecosystem services and their valuation • Ecological Modeling: o Ecosystem processes and modeling approaches o Vegetation-water interactions o Nutrient cycling and biogeochemical processes o Ecological response to hydrological disturbances • Coupled Hydrological and Ecological Modeling: o Model integration and calibration o Application of coupled models to real-world problems o Uncertainty analysis and model evaluation • Eco-hydrological Applications: o Watershed management and restoration o Climate change impacts and adaptation o Ecosystem-based management and policy
13	Teaching and learning techniques	• Lectures: Formal presentations on specific topics. • Seminars: Interactive discussions and presentations by faculty and guest speakers. • Problem-solving sessions: Application of modeling techniques to practical problems • Online learning: Flexible access to course materials and interactive online platforms.
14	Assessments	• Assignments: Homework problems and case studies • Final exam: To assess understanding of core concepts and Comprehensive evaluation of knowledge and problem-solving skills • Research paper or project: To apply course concepts to a real-world problem and demonstrate independent research abilities • Presentations: Communication of modeling results • Class participation: To encourage active engagement and critical thinking
15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	-
	16.2. References	• *Eco-hydrology* by Ignacio Rodriguez-Iturbe and • A. Porporato, *Hydrological Processes* by Roger Scruton

		• Journal articles: *Water Resources Research*, *Hydrology and Earth System Sciences*, *Ecological Modelling*
	16.3. Lab Materials and Equipment	Software: SWAT, MODFLOW, MIKE SHE, R, Python
	16.4. Website, ICT and Digital Technology	Online resources: NASA Earthdata, USGS Water Resources, FAO Water Resources,
17	Assessment rubrics	• Assignments, research project evaluation, class participation: 50% • Final Exam: 50%

CENG 8617: Pollutant Fate and Transport in the Water Environment

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Pollutant Fate and Transport in water environment

No	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Elective
2	Core competencies Students will be able to:	• Describe the fundamental principles of contaminant transport in surface water and groundwater systems. • Apply mathematical models to simulate the fate and transport of pollutants in aquatic environments. • Evaluate the impact of various physical, chemical, and biological processes on pollutant behavior. • Design and conduct experiments to investigate pollutant fate and transport processes. • Understand existing national environmental policies and strategies
3	Course Type	Elective
4	Course Identifiers	
	4.1. Course Code	CENG 8617
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office and Office Hrs	 Mebruk Mohammed (PhD) mebruk.mohammed@aait.edu.et Office No. 224 A
8	Course Description	This course provides a comprehensive understanding of the physical, chemical, and biological processes governing the transport and transformation of pollutants in aquatic environments. It emphasizes the application of quantitative modeling techniques to predict pollutant fate and transport, and to evaluate the effectiveness of existing pollution related environmental policies and strategies.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes Students will be able to:	• Describe the fundamental principles of contaminant transport in surface water and groundwater systems. • Apply mathematical models to simulate the fate and transport of pollutants in aquatic environments.

		• Evaluate the impact of various physical, chemical, and biological processes on pollutant behavior. • Design and conduct experiments to investigate pollutant fate and transport processes. • Understand existing national environmental policies and strategies
12	Course Contents	• Introduction to water quality parameters and pollutants • Hydrological and hydrodynamic processes in surface water and groundwater • Contaminant transport processes: advection, dispersion, diffusion, and sorption • Chemical and biological transformation processes • Reactive transport modeling • Fate and transport of non-aqueous phase liquids • Case studies of contaminant transport and remediation • Advanced topics in pollutant fate and transport (*e.g.*, nanoparticles, emerging contaminants) • Environmental policies and strategies of Ethiopia
13	Teaching and learning techniques	• Lectures: Formal presentations on specific topics. • Seminars: Interactive discussions and presentations by faculty and guest speakers. • Online learning: Flexible access to course materials and interactive online platforms.
14	Assessments	• Assignments: Homework problems and case studies • Final exam: To assess understanding of core concepts and Comprehensive evaluation of knowledge and problem-solving skills • Research paper or project: To apply course concepts to a real-world problem and demonstrate independent research abilities • Class participation: To encourage active engagement and critical thinking
15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	-
	16.2. References	• Elsevier, Principles of contaminant Transport in soil • J. Wiley, 2005, Integrated Environmental Modelling, Hoboken, NJ, • Wilbert Lick, 2009, Sediment and contaminant transport in surface waters • Zheng Chunmiao, Applied Contaminant Transport modelling, New York
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Technology	-
17	Assessment rubrics	• Assignments, research project evaluation, class participation: 50% • Final Exam: 50%

CENG 8618: Advanced Urban Drainage System Engineering

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Advanced Urban Drainage System Engineering

No	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Elective
2	Core competencies Students will be able to:	• Critically analyze the hydrological and hydraulic characteristics of urban areas. • Design and evaluate advanced urban drainage systems, including sustainable drainage systems (SUDS). • Apply advanced modeling techniques for simulating and optimizing urban drainage systems. • Assess the impact of climate change on urban drainage systems and develop adaptation strategies. • Develop and implement innovative solutions for managing urban storm water and wastewater..
3	Course Type	Elective
4	Course Identifiers	
	4.1. Course Code	CENG 8618
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office and Office Hrs	 - - -
8	Course Description	This course delves into the advanced concepts and methodologies for the design, analysis, operation, and management of urban drainage systems. It focuses on addressing complex challenges posed by urbanization, climate change, and water quality concerns. Students will develop a comprehensive understanding of the hydrological and hydraulic processes governing urban drainage systems, as well as the application of advanced modeling and optimization techniques for sustainable and resilient urban water management.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.

11	Learning Outcomes Students will be able to:	• Master advanced concepts in urban hydrology, hydraulics, and water quality. • Develop expertise in the application of hydrological and hydraulic models for urban drainage analysis. • Gain proficiency in designing and evaluating SUDS. • Understand the challenges and opportunities related to climate change and urban drainage. • Develop critical thinking and problem-solving skills in addressing complex urban water management issues.
12	Course Contents	• Advanced Urban Hydrology: o Urban rainfall characteristics and intensity-duration-frequency analysis o Infiltration and runoff modeling o Urban watershed modeling • Advanced Urban Hydraulics: o Hydraulic analysis of complex drainage networks o Unsteady flow modeling o Sewer system design and analysis o Pump station design and operation • SUDS: o Principles of SUDS o Design and implementation of SUDS measures o Performance evaluation of SUDS • Urban Drainage Modeling: o Advanced modeling techniques (SWMM, MIKE URBAN, etc.) o Model calibration and validation o Uncertainty analysis in urban drainage modeling • Climate Change Impacts on Urban Drainage: o Climate change projections and impacts o Adaptation strategies for urban drainage systems o Extreme event analysis and management • Urban Water Quality Management: o Stormwater quality management o Combined sewer overflows (CSOs) o Water quality modeling o Treatment technologies
13	Teaching and learning techniques	• Lectures: Formal presentations on specific topics. • Seminars: Interactive discussions and presentations by faculty and guest speakers. • Problem-solving sessions: Application of modeling techniques to practical problems • Online learning: Flexible access to course materials and interactive online platforms.
14	Assessments	• Assignments: Homework problems and case studies • Final exam: To assess understanding of core concepts and Comprehensive evaluation of knowledge and problem-solving skills • Research paper or project: To apply course concepts to a real-world problem and demonstrate independent research abilities • Presentations: Communication of modeling results

		• Class participation: To encourage active engagement and critical thinking
15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	Textbooks on urban hydrology, hydraulics, and water quality
	16.2. References	• Academic journals (Journal of Hydrology, Water Resources Research, Journal of Hydraulic Engineering, etc.) • Technical reports and guidelines from relevant organizations
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Technology	- Urban drainage modeling software (SWMM, MIKE URBAN, etc.)
17	Assessment rubrics	• Assignments, research project evaluation, class participation: 50% • Final Exam: 50%

CENG 8631: Sustainable Water Supply Systems

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Sustainable water supply systems

No	Section	Contents
1	Module:	
	1.1. Module Title	Elective
	1.2. Type of Module	Lecture
2	Core competencies Students will be able to:	• Critically evaluate the sustainability of existing water supply systems. • Develop and implement strategies for water conservation and demand management. • Design and optimize water supply systems considering multiple objectives and constraints. • Assess the impacts of climate change and population growth on water resources and infrastructure. • Apply advanced modeling and decision-making tools for water resources management.
3	Course Type	Lecture
4	Course Identifiers	
	4.1. Course Code	CENG 8631
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I
6	Prerequisite	none
7	Instructor Name Contact information Office and Office Hrs	 - - -
8	Course Description	This course provides an advanced understanding of the principles, methodologies, and technologies for designing, developing, and managing sustainable water supply systems. It emphasizes the integration of environmental, social, and economic considerations to ensure long-term water security and resilience. Students will explore innovative approaches to water resource management, including water conservation, reuse, and desalination, while considering the impacts of climate change and population growth.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill course requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes	• Understand the concept of water security and its relationship to sustainable development.

	Students will be able to:	• Master advanced techniques for water demand assessment and forecasting. • Develop expertise in water supply system planning, design, and operation. • Evaluate the environmental and social impacts of different water supply options. • Gain proficiency in using advanced modeling and simulation tools for water resources management.
12	Course Contents	• Water Security and Sustainability: o Concepts of water security and resilience o Global water challenges and opportunities o Sustainable development goals related to water • Water Demand Management: o Water demand forecasting and analysis o Water conservation strategies and technologies o Pricing and economic instruments for water management • Water Supply Planning and Design: o Water supply system components and design criteria o Water quality management and treatment o Integration of renewable energy sources • Integrated water resources management models • Climate Change Adaptation: o Impacts of climate change on water resources o Adaptation strategies for water supply systems o Drought and flood management
13	Teaching and learning techniques	• Lectures: Formal presentations on specific topics. • Seminars: Interactive discussions and presentations by faculty and guest speakers. • Problem-solving sessions: Application of modeling techniques to practical problems • Online learning: Flexible access to course materials and interactive online platforms.
14	Assessments	• Assignments: Homework problems and case studies • Final exam: To assess understanding of core concepts and Comprehensive evaluation of knowledge and problem-solving skills • Research paper or project: To apply course concepts to a real-world problem and demonstrate independent research abilities • Presentations: Communication of study and modelling results • Class participation: To encourage active engagement and critical thinking
15	Course Policy	Students are required to: attend at least 85% of lectures; adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during lectures; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	Textbooks on water resources management, hydrology, hydraulics, and water quality

	16.2. References	• Academic journals (Water Resources Research, Journal of Hydrology, Journal of Water Resources Planning and Management, etc.) • Technical reports and guidelines from international organizations (UNESCO, WHO, World Bank)
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Technology	• Online databases and resources (*e.g.*, Water Resources Management Portal, Global Water Partnership) • Water resources modeling software (*e.g.*, MODFLOW, MIKE SHE, SWMM)
17	Assessment rubrics	• Assignments, research project evaluation, class participation: 50% • Final Exam: 50%

CENG 8632: Seminar-I

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Seminar-I

No	Section	Contents
1	Module:	
	1.1. Module Title	Seminar
	1.2. Type of Module	Lecture
2	Core competencies Students will be able to:	• Critical thinking and analysis skills • Effective communication and presentation abilities • Advanced knowledge of research methodologies and findings in the field • Ability to engage in scholarly discussions and debates • Capacity to synthesize and integrate complex information
3	Course Type	Seminar
4	Course Identifiers	
	4.1. Course Code	CENG 8632
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I, Semester I
6	Prerequisite	none
7	Instructor Name Contact information Office & Office Hrs	 - - -
8	Course Description	Seminars provide a platform for advanced scholarly discourse, critical analysis, and knowledge dissemination within the field of Water Supply and Environmental Engineering. The course involves regular presentations by faculty, students, and invited experts on current research, emerging trends, and critical issues.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill seminar requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes Students will be able to:	• Critically evaluate research papers and presentations • Develop and deliver effective oral presentations • Participate actively in academic discussions • Identify research gaps and potential research directions • Build a strong professional network within the field
12	Course Activities	• Presentations by PhD students on their research progress • Invited lectures by renowned experts in the field • Discussions on current research trends and challenges • Critical analysis of seminal research papers

		• Practice in developing and delivering research presentations
13	Teaching and learning techniques	• Student presentations • Faculty-led discussions • Peer review of presentations • Guest lectures • Panel discussions
14	Assessments	• Seminar participation and engagement • Quality of student presentations • Written critiques of peer presentations • Attendance and punctuality
15	Course Policy	Students are required to: adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during seminars; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	-
	16.2. References	-
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Technology	-

17	Assessment rubrics	• Reviews of researches: 50%
		  ○ Content Knowledge
		  ○ Critical Thinking
		  ○ Organization
		  ○ Citation: Proper citation of sources
		  ○ Group work: Collaboration and teamwork (if applicable)
		• Presentations: 50%
		  ○ Q&A
		  ○ Presentation Skills
		  ○ Visual aids: Effectiveness of slides, handouts, or other visual materials
		  ○ Time management: Ability to stay within the allotted time frame

CENG 8633: Seminar-II

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: Seminar-II

No	Section	Contents
1	Module:	
	1.1. Module Title	Seminar
	1.2. Type of Module	Lecture
2	Core competencies Students will be able to:	• Critical thinking and analysis skills • Effective communication and presentation abilities • Advanced knowledge of research methodologies and findings in the field • Ability to engage in scholarly discussions and debates • Capacity to synthesize and integrate complex information
3	Course Type	Seminar
4	Course Identifiers	
	4.1. Course Code	CENG 8633
	4.2. Credit Hrs/ECTS	6 ECTS
5	Semester and Year	Year I, Semester II
6	Prerequisite	CENG 8632 – Seminar-I
7	Instructor Name Contact information Office & Office Hrs	 - - -
8	Course Description	Seminars provide a platform for advanced scholarly discourse, critical analysis, and knowledge dissemination within the field of Water Supply and Environmental Engineering. The course involves regular presentations by faculty, students, and invited experts on current research, emerging trends, and critical issues.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all assignments and projects submitted by students to fulfill seminar requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The instructor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.
11	Learning Outcomes Students will be able to:	• Critically evaluate research papers and presentations • Develop and deliver effective oral presentations • Participate actively in academic discussions • Identify research gaps and potential research directions • Build a strong professional network within the field
12	Course Activities	• Presentations by PhD students on their research progress • Invited lectures by renowned experts in the field • Discussions on current research trends and challenges

		• Critical analysis of seminal research papers • Practice in developing and delivering research presentations
13	Teaching and learning techniques	• Student presentations • Faculty-led discussions • Peer review of presentations • Guest lectures • Panel discussions
14	Assessments	• Seminar participation and engagement • Quality of student presentations • Written critiques of peer presentations • Attendance and punctuality
15	Course Policy	Students are required to: adhere to the established classroom code of conduct; meet all assignment submission deadlines; refrain from using cellphones during seminars; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	-
	16.2. References	-
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Technology	-

17	Assessment rubrics	• Reviews of researches: 50%
		  ○ Content Knowledge
		  ○ Critical Thinking
		  ○ Organization
		  ○ Citation: Proper citation of sources
		  ○ Group work: Collaboration and teamwork (if applicable)
		• Presentations: 50%
		  ○ Q&A
		  ○ Presentation Skills
		  ○ Visual aids: Effectiveness of slides, handouts, or other visual materials
		  ○ Time management: Ability to stay within the allotted time frame

CENG 9600: PhD Dissertation

College: Addis Ababa Institute of Technology
Department: Civil and Environmental Engineering
Program: PhD Water Supply and Environmental Engineering
Course Title: PhD Dissertation

No	Section	Contents
1	Module:	
	1.1. Module Title	Research
	1.2. Type of Module	Research
2	Core competencies Students will be able to:	• Advanced knowledge of water resources engineering principles: Hydrology, hydraulics, water quality, and water treatment processes. • Strong foundation in environmental engineering: Solid & Sanitary Waste management, air pollution, and EIA. • Proficiency in research methodologies: Experimental design, data analysis, statistical modeling, and scientific writing. • Ability to conduct independent research: Identifying research gaps, formulating research questions, and developing research methodologies. • Critical thinking and problem-solving skills: Analyzing complex water and environmental challenges and proposing innovative solutions.
3	Course Type	Research
4	Course Identifiers	
	4.1. Course Code	CENG 9600
	4.2. Credit Hrs/ECTS	120 ECTS
5	Semester and Year	Year II and above
6	Prerequisite	CENG 8633 – Seminar-II
7	Instructor Name Contact information Office & Office Hrs	 - - -
8	Description	PhD Dissertation constitutes the core of the PhD program in Water Supply and Environmental Engineering. It is designed to cultivate independent research capabilities, critical thinking, and problem-solving skills. Students will conceptualize, design, execute, and disseminate original research contributing to the advancement of knowledge in the field.
9	Integrity Statement	As per the legislation established by the AAU Senate, it is mandated that all dissertation contents submitted by students to fulfill dissertation requirements must be original and represent the individual's own efforts. Engaging in unethical practices such as cheating or misrepresenting the work of others as one's own will lead to a failing grade and may incur additional disciplinary actions.
10	Students with Disability	The advisor and the university's designated offices ensure that all available resources and assistance are offered to students with disabilities.

11	Learning Outcomes Students will be able to:	• Formulate a research question and develop a research plan. • Conduct literature review to identify knowledge gaps and research opportunities. • Collect, analyze, and interpret data to address the research question. • Effectively communicate research findings through written and oral presentations. • Contribute to the advancement of knowledge in the field of Water Supply and Environmental Engineering.
12	Dissertation activities	• Concept note development • Research proposal development (writing and oral defense) • Literature review and research methodology • Data collection and analysis • Publish on Peer reviewed journals and/or conferences • Dissertation writing and presentation • Dissertation defense
13	Teaching and learning techniques	• One-on-one supervision: Regular meetings with the advisor to discuss research progress, challenges, and strategies. • Research presentations: Opportunities to present research findings to peers, faculty, and external experts. • Literature review and critical analysis: Extensive engagement with relevant research literature to develop a strong theoretical foundation. • Data collection and analysis: Application of appropriate research methodologies and statistical techniques. • Research proposal development: Formulation of a clear and comprehensive research proposal outlining research objectives, methodology, and expected outcomes. • Dissertation writing: Development of a well-structured and coherent dissertation that effectively communicates research findings.
14	Assessments	• The research module is primarily assessed through the completion of published articles and a doctoral dissertation.
15	Course Policy	Students are required to: adhere to the established advising code of conduct; meet all assignment submission deadlines; and avoid any forms of unacceptable behavior, including plagiarism and cheating.
16	Learning Resources	
	16.1.Textbooks	-
	16.2. References	-
	16.3. Lab Materials and Equipment	-
	16.4. Website, ICT and Digital Tech.	-

17	Assessment rubrics	• Initial assessments
		  ○ Progress reports, Research proposals, and Oral defenses.
		  ○ Published articles: Peer reviewed journals/conferences
		• Dissertation
		  ○ Originality, Contribution to knowledge, Research methodology, Data analysis, Clarity of presentation, and Adherence to academic standards.