

Arctic Engineering GRADUATE STUDENT HANDBOOK

Guidelines for Students
in the
University of Alaska Anchorage
Arctic Engineering Graduate Program



UAA College of Engineering
UNIVERSITY of ALASKA ANCHORAGE

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Guidelines for Students in the University of Alaska Anchorage Arctic Engineering Graduate Program

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University of Alaska Anchorage, College of Engineering
907-786-1900 <http://www.uaa.alaska.edu/civilengineering/arctic/>

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Arctic Engineering
GRADUATE STUDENT HANDBOOK

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ARCTIC ENGINEERING GRADUATE STUDENT HANDBOOK

Guidelines for
Arctic Engineering Graduate Students
University of Alaska Anchorage

Why Study Arctic Engineering?

As our 21st century world turns to the north for mineral resources and global supply logistics, there is a sustained demand for engineers, in both the commercial and public service sectors, who are trained to solve problems in cold regions. UAA's Arctic Engineering program provides a specialized curriculum to prepare professionals for:

- Development of cold regions' natural resources,
- Multi-modal transportation improvements in cold regions,
- Design and operation of constructed works in rural communities and winter cities where snow, ice, and frozen ground constrain the efficacy of conventional methods, and
- Evaluation of climate change impacts on northern infrastructure.

Climate models consistently show that Arctic regions of the world are the most sensitive to global warming. Recent scientific findings indicate that physical characteristics of Arctic atmosphere, ocean, and land have been changing since the 1970s. As a result, Arctic research has growing national and global importance.

UAA's College of Engineering has responded to these trends with a series of new research initiatives aimed at evaluating and responding to climate change impacts on infrastructure in cold regions. UAA Arctic Engineering faculty members are leaders in national and international efforts to prepare northern civilizations for the changes of this millennium.

Arctic Engineering at UAA

The Masters of Science in Arctic Engineering degree curriculum is designed to be delivered online to provide graduate education for engineers who must deal with the unique challenges of design, construction, and operations in cold regions of the world. Special problems created by the climatic, geological and logistical conditions of the Arctic and sub-Arctic require knowledge and techniques that are rarely presented in conventional engineering courses. A thorough knowledge of heat transfer processes and properties of frozen ground and frozen water is basic to conducting most engineering activities in the cold regions. The subject areas of hydraulics, hydrology, materials and utility operations are also uniquely impacted by Arctic considerations. The Arctic Engineering program requires completion of a set of core courses which prepare engineers to understand and adapt prior engineering knowledge and skills to problems of cold regions. The program also allows students to study advanced elective courses in a particular area of specialized interest. Research activities carried out by faculty of the UAA College of Engineering provide opportunities for project reports utilizing current Arctic knowledge. A graduate Advisory Committee composed of at least three members—of which the Chair and one other member must be UAA Arctic Engineering faculty—is appointed to guide each admitted student to degree completion. Additional program guidance is available via the URL referenced above.

Upon successful completion of the program, students will have gained sufficient knowledge to:

1. Recognize natural conditions and engineering challenges that are unique to cold regions;
2. Interpret associated specialized language and units of measure;

3. Locate, interpret, and apply public information about the physical conditions of cold regions;
4. Apply fundamental physical principles to achieve solutions to common cold regions engineering problems;
5. Assess the need for complex specialized Arctic engineering solutions;
6. Determine physical and thermal properties, evaluate frost heave rates, and estimate heat flow in soils; prevent foundation failure due to seasonally or perennially frozen ground by appropriate project site exploration and design of constructed features;
7. Determine mathematical and physical properties governing heat and mass transfer in cold climates;
8. Determine temperature profiles in structure walls, roofs, and foundations; predict moisture content and mass flow rates in structures;
9. Acquire, integrate, and interpret data from public archives regarding site conditions associated with planning and design of community utility systems and formulate field measurement programs to determine site conditions for planning and design;
10. Analyze properties of lake, river, and sea ice; predict behavior of ice under natural conditions, and predict ice forces on engineering structures; and
11. Apply the sum of specialized Arctic engineering knowledge and skills gained in the program toward solutions for practical engineering problems and report these to fellow specialists.

Admission to the Arctic Engineering Program at UAA

All students admitted to the Arctic Engineering program must have previously earned a baccalaureate degree in an engineering discipline with a cumulative undergraduate GPA of at least 3.00. Probationary admission may be granted by the Civil Engineering Department for students whose cumulative undergraduate GPA is between 2.50 and 3.00, but who have successfully completed graduate studies at the 3.00 level or better and have other evidence of their potential for success in graduate engineering studies. Probationary terms will typically call for successful completion of a pre-approved sequence of 9 credits of graduate engineering courses. Admitted students are also responsible for completion of prerequisites for Arctic engineering program courses which may not have been included in their undergraduate education.

Applications for admission to UAA graduate programs are submitted online via: <http://www.uaa.alaska.edu/admissions/>.

From admission through graduation, continuous registration is expected every fall and spring semester until all requirements for the degree are completed. To make continuous progress in their graduate program, students have the option of a) registering for at least one (1) graduate level credit applicable to their graduate degree or b) paying the continuous registration fee to remain active in the graduate program, even though not registered in any courses.

Registration for Classes

Students register for classes online via the UAOnline at <https://uaonline.alaska.edu/>. Online classes are accessed via the UAA Blackboard system at: <http://uaa.alaska.edu/classes>.

Graduate Studies Plan. The graduate studies plan (list of courses) is based upon catalog requirements for the Arctic Engineering MS degree (see Program Requirements below). No formal plan is submitted to Graduate School for this program.

Graduate Advisory Committee. A student's Graduate Advisor typically acts as Chair of that student's Graduate Advisory Committee. The advisor and the student select a Graduate Studies Committee consisting of at least 3 members. Two (including the Chair) must be UAA College of

Engineering full-time faculty members. One committee member may be from a discipline outside the College of Engineering and may be an Adjunct or Affiliate UAA Professor. Additional members who are not UAA faculty, but have appropriate professional credentials, may be included with the approval of the Arctic Engineering program Chair, the committee chair, and the student.

The graduate advisor and committee will:

1. Approve elective courses.
2. Review and approve the Arctic Engineering project, including the initial proposal.

UAA Graduation Requirements

Candidates must submit an Application for Graduation to Enrollment Services, along with the application fee, no later than the published due date (see Academic Calendar at <http://www.uaa.alaska.edu/records/calendar/>). Applications received after the deadline will be processed for the following semester.

See the UAA Catalog for University Requirements for Graduate Degrees (<http://catalog.uaa.alaska.edu/graduateprograms/degree requirements/>).

Master of Science in Arctic Engineering, Program Requirements

1. Candidates must complete the following core courses (9 credits):
AE A603 Arctic Engineering* (3 credits)
AE A681 Frozen Ground Engineering (3 credits)
AE A685 Arctic Heat and Mass Transfer (3 credits)
*Students who have completed AE/CE A403 Arctic Engineering with a grade of C or better, or students who have passed the ES AC030 Fundamentals of Arctic Engineering or ES AC031 Introduction to Arctic Engineering before being admitted to the program must replace AE A603 with an elective, 3-credit course accepted by the student's graduate advisory committee.
2. Candidates must also complete at least three additional courses from among the following Arctic engineering program elective courses (9 credits):
AE A682 Ice Engineering (3 credits)
AE A683 Arctic Hydrology and Hydraulic Engineering (3 credits)
AE A684 Arctic Utility Distribution (3 credits)
AE A689 Cold Regions Pavement Design (3 credits)
3. To fulfill the minimum 30-credit degree requirement, candidates must complete additional graduate electives (9 credits) in mathematical, science or engineering subjects related to or supportive of the student's program of study, as approved by the student's advisory committee. Provided a grade of B or better is achieved, one technical undergraduate elective course at the 400 level may be applied to this requirement with prior permission of the student's advisory committee. All coursework applied toward degree requirements must be approved by the student's advisory committee.
4. Each student must complete the following course (3 credits) after approval of a project proposal by the student's advisory committee:
AE A698 Arctic Engineering Project 3
The Arctic Engineering project should have the following characteristics:
 - a) The Arctic Engineering project must solve a practical engineering problem to the extent that original developments by the candidate are instrumental and evident in the project report.
 - b) The project problem and solution must be presented in the context of the current state-of-the-art by means of a thorough review of pertinent literature.
 - c) The project must include innovative components directly involving cold regions engineering.
 - d) The project must have sufficient scope to clearly demonstrate the candidate's

- e) advanced technical expertise in cold regions engineering.
 - f) The project report must demonstrate command of knowledge and skills directly associated with the candidate's graduate program of study.
 - g) In the judgment of the candidate's advisory committee, the written project report must be publishable in the proceedings of a cold regions engineering specialty conference.
 - h) The work must require a level of effort consistent with three semester hours of credit (approximately 45 to 60 hours per credit hour, or 135 to 180 hours total effort).
 - 5. UAA's Graduate School requires a Project Submission Packet. See <https://www.uaa.alaska.edu/graduateschool/uaa-graduate-school-projects.cfm> for detailed information.
5. A total of 30 credits is required for the degree.

Research Assistantships. Faculty and research staff of the College of Engineering may have research grant support available for full time graduate students who are registered in 3 courses per semester, for assisting with laboratory or field measurements, data analysis, numerical simulations, and related aspects of academic research projects. The number and type of research projects varies from time to time. Informal inquiries to the Dean, Program Chairs, or individual faculty are the best way to seek out and apply for research assistantships.

Other financial aid. A variety financial aid programs, including college loans, are administered through the UAA Student Financial Aid office. More information is available at <http://www.uaa.alaska.edu/financialaid/>

Arctic Engineering Faculty

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Arctic Engineering Project Report Guidelines

The Graduate Project Submission Package requires certain forms (see <http://www.uaa.alaska.edu/graduateschool/uaa-graduate-school-projects.cfm>) and title and signature pages. See full explanations at the aforementioned web page, and examples specific to Arctic Engineering MS degree below. The Graduate School requires that you follow the format required for your thesis as closely as possible (see <http://www.uaa.alaska.edu/graduateschool/thesis/index.cfm>).

Sample Title and Signature Page

TITLE PAGES MUST HAVE THE EXACT
TITLE AS THE SIGNATURE PAGE

A
PROJECT

Presented to the Faculty
of the University of Alaska Anchorage

in Partial Fulfillment of the Requirements
for the Degree of

MASTER OF SCIENCE IN ARCTIC ENGINEERING

By

Will Wheaten, B.S.

Anchorage, Alaska

May or December YEAR

SIGNATURE PAGE –AN EXAMPLE:

SIGNATURE PAGES DO NOT HAVE PAGE NUMBERS

By

Will Wheaton

RECOMMENDED:

Committee Member, Ph.D., P.E.

Committee Member, Ph.D., P.E.

Committee Chair, Ph.D., P.E.
Chair, Advisory Committee

Program Chair, Ph.D., P.E.
Chair, Arctic Engineering Program

APPROVED:

Kenrick Mock, Ph.D.
Associate Dean, College of Engineering

Date