

## ENVI 122 – Energy Efficient Building Design and Simulation

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| <b>Course Title:</b>    | Energy Efficient Building Design and Simulation |
| <b>Dept. &amp; Num:</b> | ENVI 122  |
| <b>Credits:</b>         | 1   |
| <b>Prerequisites:</b>   | None  |
| <b>Dates:</b>           | Fri-Sun, May 7-9, 2021                          |
| <b>Days and Times:</b>  | Fri 6pm-9pm, Sat 9am-11:30am, Sun 9am-5pm       |
| <b>Location:</b>        | online  |

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| <b>Instructor:</b>      | Dr. Tom Marsik   |
| <b>Office Location:</b> | Cold Climate Housing Research Center                       |
| <b>Position:</b>        | Associate Professor  |
| <b>Phone:</b>           | 450-1785   |
| <b>Email:</b>           | <a href="mailto:tmarsik@alaska.edu">tmarsik@alaska.edu</a> |
| <b>Hours Available:</b> | Available during the days the course is offered            |

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|-----------------------|--|
| <b>Required Text:</b> | 1) Alaska Residential Building Manual, Rich Seifert et al., UAF Cooperative Extension Service / Alaska Housing Finance Corporation, 2008. Available free online from <a href="https://www.ahfc.us/application/files/2813/5716/1325/building_manual.pdf">https://www.ahfc.us/application/files/2813/5716/1325/building_manual.pdf</a> |
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### Course Description:

In this course, students gain basic practical knowledge related to the process of designing energy efficient buildings, as applied to both new construction and retrofits. Main topics covered include basic building science, principles and techniques of energy efficient construction, and building energy simulations. The class also covers the basics of the Passive House Standard, which refers to super energy efficient buildings that don't need a conventional heat source; solar gain, body heat, and heat from electrical lighting and appliances are sufficient to cover the majority of needed heat.

### Course Goals:

The general goals of this course are to provide basic education in energy simulations of buildings and help students make educated decisions during the design process of new buildings and retrofits.

### Student Learning Outcomes:

Upon successful completion of this course, students will be able to:

- Discuss basic building science concepts and apply them in the energy efficient building design process.
- Describe common energy efficient building techniques.
- Explain the specifications of the Passive House standard.
- Use energy simulations software for building design at a basic level.
- Apply understanding of energy efficient building techniques to create suitable designs for conditions at specific locations.

### Instructional Methods:

- Lectures
- Simulation exercises
- Discussions
- Case studies
- Homework
- Readings

### Course Calendar:

#### Friday

|               |  |
|---------------|--|
| 6:00pm-7:00pm | Course introduction                          |
| 7:00pm-9:00pm | Basic building science – heat, air, moisture |

#### Saturday

|                 |  |
|-----------------|--|
| 9:00am-9:30am   | Start Design Project (see details in the Evaluation section below) – examine Passive Office drawings |
| 9:30am-10:30am  | Tour of the Passive Office (online)  |
| 10:30am-11:30am | End Design Project (Passive Office energy simulation)  |

### **Sunday**

|                 |   |
|-----------------|---|
| 9:00am-9:30am   | Basic physics of heat (define Heating Degree Days)  |
| 9:30am-10:00am  | Heat recovery ventilators (HRVs)  |
| 10:00am-11:00am | Passive House standard  |
| 11:00am-12:00pm | Energy efficient building techniques  |
| 12:00pm-1:00pm  | Working lunch - case study – Net Zero Energy Ready Home in Dillingham, Alaska                   |
| 1:00pm-2:00pm   | Energy simulations by month   |
| 2:00pm-3:00pm   | Advanced simulations using Passive House Planning Package (PHPP)                                |
| 3:00pm-4:00pm   | Simulation exercises + discussion of simulation results done as HW (see Homework section below) |
| 4:00pm-5:00pm   | Final exam  |

### **Course Policies:**

1. UAF requires students to conduct themselves honestly and responsibly, and to respect the rights of others.
2. Attendance is mandatory.
3. Late assignments will not be accepted without prior approval of instructor.
4. The instructor reserves the right to amend this course outline as needed.

### **Evaluation:**

Final grades are calculated from the points earned in the following areas:

**Attendance and Participation** ..... 10%

Students are expected to attend the entire 3-day classroom session and actively participate in group discussions.

**Design Project** ..... 25%

In the class project, students will actively participate in designing an energy efficient building (the design is typically based on UAF BBC's experimental structure known as Passive Office, unless the whole group agrees on a different building) and verifying it's performance by simulations. Under the observation of the instructor, they will demonstrate understanding of the design process and simulations. Even though the project will be done together as a team, each individual's contribution will be evaluated using the following rubric:

|   | <b>2 pts</b>  | <b>1 pts</b>   | <b>0 pts</b>  |
|---|---|--|---|
| <b>Ability to apply understanding of building science in the design process</b>                   | Student has a good understanding of building science and a good ability to use it to design an efficient building | Student has a fair understanding of building science but lacks the ability to apply it in the design process.          | Student has a lack of understanding of building science and is unable to design a functional structure. |
| <b>Ability to calculate the building's parameters and enter them into the simulation software</b> | Student has a good ability to calculate the building's parameters and enter them into the simulation software.    | Student has some difficulties in calculating the building's parameters and entering them into the simulation software. | Student is unable to calculate the building's parameters and enter them into the simulation software.   |
| <b>Ability to interpret simulation results</b>  | Student has good abilities to interpret the results and use the results to improve the building design.           | Student has some difficulties in interpreting the results and unsure about how the design could be improved.           | Student is unable to interpret the results.   |
| <b>Attitude / Behavior</b>  | Student is engaged in the project and respectful of others.   | Student is engaged in the project but not respectful of others, or vice versa, or a little bit of both.                | Student is disrespectful of others and not engaged in the project.                                      |

**Homework** ..... 30%

Each student will be required to perform an assessment of basic energy parameters of his/her home and simulate the energy performance of the home using provided software. The student will then identify ways to make his/her home more energy efficient, perform energy simulations of the improved home, and elaborate on the effectiveness of the chosen improvements. The homework will be assigned on Saturday and due on Sunday morning.

**Final Exam** ..... 35%

An open book, open notes, final exam will cover material from the whole course.

### **Grading Policy:**

This course will be graded pass/fail. In order to receive a passing grade, students must receive a 70% or higher grade.

**Student Protections Statement:**

UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site:

<https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities>.

I will work with the [Office of Disability Service](#) to provide reasonable accommodation to students with disabilities. Contact information: [uaf-disability-services@alaska.edu](mailto:uaf-disability-services@alaska.edu)

Phone: 907.474.5655 or TTY: 907.474.1827 or Fax: 907.474.5688

**Support Services:**

Go to the Student Handbook ([www.uaf.edu/handbook](http://www.uaf.edu/handbook)) for things like: academic advising, tutoring, library and academic support, disability services, computing and technology, veteran and military support, academic complaint and appeals, late withdrawals, "classroom" behavior expectations and more.

**Notice of Nondiscrimination:**

UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual:

[www.alaska.edu/nondiscrimination](http://www.alaska.edu/nondiscrimination).

**COVID-19 Statement:**

Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.