

ENVS 294- W5 Passive House and Net Zero Energy Buildings

Spring 2021
Online Course

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COURSE DESCRIPTION: Credits 3. Reduction of energy consumption of buildings is an important step towards a sustainable future. With a focus on the concept of highly energy-efficient buildings, this course explores the passive buildings design ideas, tools, and strategies to use natural energies (solar, wind, and geothermal, etc.) available in the local climate, providing heating, cooling, ventilation and daylighting for indoor environments. It also explains building-integrated systems (BIPV¹, BIWT², etc.) in net zero energy buildings, to convert renewable energies into electrical energy. It helps students to understand how a well-designed net zero building can produce with on-site renewables the same, or more, amount of energy as it consumes on an annual basis. Zero energy and passive strategies are very scalable from single family homes, to large commercial buildings, to districts or communities of buildings. The course reviews PHIUS³ and NZEB⁴ certification programs, requirements, and process, as evaluation systems of energy efficient buildings. It employs a mix of brief lectures, readings, videos, films and online discussions to engage students in learning and provide opportunities for them to move from consumers to creators, to successfully manage their energy budgets, reducing fossil fuel usage and GHG emissions, and improving comfort, health and well-being (addressing to the UN Sustainable Development 3, 7, 8, 9, 11, 12, 13 Goals⁵).

COURSE OBJECTIVES:

Upon completion of this course the student will be able to:

1. Explain the impact of building as the largest contributor to climate change, on natural environment and human health and well-being.
2. Relate the concept of sustainable buildings to the UN SDGs.
3. Discuss the passive design and net zero buildings as energy-efficient solutions, to enhance occupants' comfort while reducing or eliminating fossil fuel usage and other contributors to climate change.
4. Describe the passive buildings design strategies, to use renewable energy sources such as the sun, wind and geothermal, to provide natural heating, cooling, ventilation and lighting for indoor environments.
5. Identify net zero energy building systems and applications, to convert (on-site/off-site) renewable energies into electrical and thermal energy.
6. Demonstrate the acquired knowledge associated with the Passive House Institute US (PHIUS) and Net Zero Energy Building (NZEB) certification programs, requirements, and process.
7. Develop skills to apply design guidelines, principles, and implications in their design projects and living, to enhance energy efficiency for various building types and climates.

¹ Building-integrated photovoltaic (BIPV)

² Building-integrated Wind Turbine (BIWT)

³ Passive House Institute US (PHIUS)

⁴ Net Zero Energy Building (NZEB)

⁵ <https://sustainabledevelopment.un.org/post2015/transformingourworld>

COURSE CONTENT OUTLINE:

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|----------|---|
| Module 1 | Week 1: Built Environment and Climate Change: Status, Challenges and Opportunities |
| | Week 2: Highly Energy-Efficient Buildings: Toward a Sustainable Future |
| Module 2 | Week 3: The Concept of Passive Buildings: Historical Overview, Ideas, and Tools |
| | Week 4/5/6: Passive Design Strategies, Principles, and Techniques - <i>Climate Issues, Thermal Comfort Requirements, Site and microclimate, Orientation, Solar Geometry/Solar Control, Window Placement, High Performance Window, Daylighting, Shading Devices, Space Arrangements, Continuous Super Insulation, Moisture Control, Air Sealing (Air-tightness), Thermal Mass, Passive Heating/Cooling, Balanced Ventilation, Heat/Energy Recovery Ventilation System (HRV/ERV), Thermal Bridging etc.,</i> |
| Module 3 | Week 7: Net-Zero Energy Buildings: Definitions, Concepts, and Classification System |
| | Week 8/9/10: Net-Zero Energy Buildings Systems, Technologies and Applications - <i>Integrated Photovoltaic System (BIPV), Solar Thermal Collectors (STC), Building-Integrated Wind Turbine (BIWT), Rooftop PV System, Ground-Mounted Solar Panels, Geothermal Heat Pumps (GHP), Combined Heat and Power (CHP) system, LED Lighting Fixtures, etc.</i> |
| Module 4 | Week 11: Passive House Institute US (PHIUS) Certification |
| | Week 12: Net Zero Energy Building (NZEB) Certification |
| Module 5 | Week 13: PHIUS and NZEB Certified Projects: Case Studies and Lessons Learned |
| | Week 14: Course Review and Practicing Group Discussion |

REQUIRED TEXT: All reference materials for this course will be provided as a posted document or link to a web-based article or video.

RECOMMENDED TEXT:

1. Iyengar, K. 2015. Sustainable Architectural Design: An Overview, Routledge.
2. Chiras, D. 2002. The Solar House: Passive Heating and Cooling. Chelsea Green Publishing.
3. Corner, D., Fillinger, J., Kwok, A. 2017. Passive House Details: Solutions for High-Performance Design, Routledge.
4. James, M. 2015. Net Zero Energy Buildings Passive House+ Renewables, Low Carbon Productions.
5. Attia, Shady. 2018. Net Zero Energy Buildings (NZEB): Concepts, Frameworks and Roadmap for Project Analysis and Implementation. Butterworth-Heinemann.

COURSE ACTIVITIES/ TEACHING STRATEGIES: The course will use a mix of brief lectures, readings, videos, films, and other instructional strategies for online courses such as virtual field trips and guided tours to engage students more in learning and provide opportunities for them to move from consumers to creators. **Students are required to take two (2) exams, five (5) module self-assessment quizzes, and five (5) module assignments** in different types of literature review, research essay/ paper, project presentation, etc. where they can exercise independent studies, either alone or in group of three. **Five (5) module online discussion forums** are also designed to as a part of class, **to encourage students to explore a topic in detail and exchange ideas on the energy-efficiency in buildings, passive design strategies, net-zero energy building systems, renewable energy technologies, Passive House Institute US (PHIUS) and Net Zero Energy Building (NZEB) certifications, etc.** Students are required to access information such as grades, lecture presentations, lecture outlines, readings, supplemental materials, videos, tools, the blog, assignments, discussions, and other resources will be available on Blackboard.

ADDITIONAL UNIQUE ASPECTS OF COURSE:

1. **Addressing the UN' Sustainable Development 3, 7, 8, 9, 11, 12, 13 Goals**⁶, this interdisciplinary course focuses on the passive design and net-zero buildings as energy-efficient sustainable solutions, to provide the opportunity for students to move from consumers to creators, to successfully manage their energy budgets, reducing fossil fuel usage, GHG emissions and other contributors to climate change, as well as improving comfort, health and well-being for a sustainable future.
2. With a focus on **Passive House Institute US (PHIUS)** certification program, requirements, and process, it (in part) prepares students for the Passive House Institute US (PHIUS) exam or becoming a Certified Passive House Designers/Consultants (CPHD/C®).
3. This course highlights the **mission of department of geography and environmental sustainability at SUNY Oneonta**, to “give students the geographic and/or environmental sustainability knowledge and skills they need to interpret social, physical and environmental influences at local, regional and global scales”⁷. This course encourages students to integrate passive design strategies and net-zero energy systems and technologies in their design projects, developing energy-efficiency buildings to improving communities, countries, and the world, while showcasing SUNY Oneonta’s commitment to sustainability.
4. This course also fulfils the **SUNY General Education attributes NS3** to help students to “understand the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis; and application of scientific data, concepts, and models in one of the natural sciences”⁸.

COURSE REQUIREMENTS:

GENERAL REQUIREMENTS:

- **Course Format** This course is delivered completely online (so you will need consistent, reliable access to the Internet) via Blackboard. The tools that are part of Blackboard (grading, information posting, emails, etc.) will be used for administration and general communication. A discussion board will be the primary tool for interaction within the class. Software such as Power Point, Adobe, Google Earth, etc. will be used to develop and view materials as well as demonstrate concepts being discussed or presented. Media to be used will include print (physical and virtual), video and audio. The media will be a combination of instructor developed material as well as material available in print or web based. The tools and media are selected in conjunction with each course module and the associated learning objectives. Projects will be presented via online webinars; if your schedule conflicts with the webinars, they will be recorded for later playback. Course components include online material, multimedia, threaded discussions and e-mail. This course is primarily asynchronous; please keep in mind that each module is designed to be completed within the designated timeframe and will include specific "due dates" for each part of the module's assignments.
- **Attendance Policy:** Success in this course is dependent on your active participation and engagement throughout the course. As such, students are required to complete all assignments by the due date, and to actively participate in class discussions. Additionally, students are expected to:
 - Log on at least three times a week – on different days in order to completely weekly assignments, assessments, discussions and/or other weekly deliverables as directed by the instructor and outlined in the syllabus;
 - Participate in the weekly threaded discussions, this means that, in addition to posting a response to the thread topic presented, students are expected to respond to each other and comment and questions from the instructor and/or other students;

⁶ <https://sustainabledevelopment.un.org/post2015/transformingourworld>

⁷ <https://suny.oneonta.edu/geography-environmental-sustainability>

⁸ <https://suny.oneonta.edu/academic-advisement/general-education>

If you find that you cannot meet the class' minimum discussion requirements due to such a circumstance, please contact your instructor as soon as possible. Students will not be marked present for the course in a particular week if they have not posted on the discussion forum and/or submit assignment/essay or complete assessment if administered in that week.

SPECIFIC REQUIREMENTS:

1. **Exams/Quizzes:** There will be **two (2) exams**; one during the semester and a **cumulative final exam** (please see attached course schedule for exam dates). In addition, there will be **five (5) module self-assessment check quizzes**. Quiz material will be drawn from the previous discussions and assigned readings. Exams/quizzes will consist of a mix of multiple choice, true/false, fill-in-the-blank and short answer questions about the material covered in that unit.
2. **Discussions/Forums:** Students are required to participate in **five (5) module online discussion forums** as a part of class, to explore a topic in detail and exchange ideas. Attendance by way of online participation is considered in the calculation of the student's final grade, as each activity is assigned a value and is counted toward the student's final grade. The instructor reserves to issue a failing grade for lack of online presence in this course.
3. **Homework/Assignments:** Students are required to conduct **five (5) module assignments/exercises**. All assignments should be completed independently unless they are specifically indicated as a team assignment by your instructor (directions for the homework assignments and group assignments will be made available on Blackboard). Students are expected to complete all assigned readings prior to each class; these may include materials supplemental to the textbook posted on Blackboard. Students must always properly cite their sources and properly credit all words, thoughts and images to the original author. Students are also responsible for completing all assignments. Due dates will be announced when the assignment is given and posted on the Blackboard calendar. You have to submit your assignments in Microsoft Word or PDF format using the Blackboard Assignment tool (digital drop boxes) on Blackboard (please plan ahead in case there are technical difficulties) unless there are extenuating circumstances, **emailed papers will not be accepted**.

***NOTE: I always aim to have assignments graded within a week of the due date, often sooner. If you don't see a score within a week, please check to make sure it was received. DO NOT WAIT until the end of the semester to check. To iterate, I will not accept missing material or reconsider missing grades after the final class.

LATE ASSIGNMENT/ MAKE-UP TEST POLICY: All assignments must be submitted online on Blackboard on the due date announced unless otherwise noted by the instructor. If you cannot submit work on time, let me know beforehand and we'll make alternate arrangements. Unexcused late work will only be accepted for up to one week after the due date, with reduced credit.

METHOD OF EVALUATION & BASIS OF FINAL COURSE GRADE DETERMINATION:

Assessment Methods:

- Professor will regularly interact with the students through discussion forums, and provide feedback validating their understanding of the fundamental course material delivered through posted readings and videos and posts, papers and projects presented by other students. Discussions will be evaluated utilizing an associated Discussion Board Participation rubric and assigned points for each discussion forum.
- Posted module assignments will be discussed and critiqued by the professor and other students. The student will be evaluated utilizing an associated Written Assignment Assessment rubric and assigned points for each assignment.
- Module self-assessment check tests will be provided in each module to assist the student in assessing their understanding of the reading assignments. These will be ungraded and credit for completion will be the only application to the final course grade.

- Community Windshield Assessment Project will be evaluated utilizing an associated rubric. The project will be submitted in a sequence of steps toward completion with each step being assessed with each own rubric.
 - Community Sustainability Intervention will be evaluated utilizing an associated rubric. The project will be submitted in a sequence of steps toward completion with each step being assessed with its own rubric.
- ***NOTE: All rubrics and their associated assessment criteria will be available to the student.**

Course Grading: Your final letter grade is determined on a **point-based scale, not percentages**. Please don't assume that percentages from other classes guarantee a particular final grade in this class. You can track your progress throughout the semester by adding up points you've earned out of the total possible.

| Course Grading: | | Total Possible |
|---|---------------|-----------------------|
| Exams | 2@30 pts each | 60 |
| Module self-assessment test quizzes | 5@8 pts each | 40 |
| Module assignments/exercises | 5@12 pts each | 60 |
| Module line discussion forums participation | 5@8 pts each | 40 |
| Total Possible course points: 200 | | |

A 190 B+ 174 C+ 154 D+ 134 F <120
 A- 180 B 166 C 146 D 126
 B- 160 C- 140 D- 120

(In other words, if you earn 180 points, you're guaranteed a B+. You would need to earn 5 more points to be guaranteed an A-). Your final grade will be posted on Blackboard within 48 hours of the final exam. Please do not email to ask if I will give you extra points or if you can complete missing assignments or extra credit after grades are posted (especially since I am required to submit final grades to the Registrar within 48 hours of the exam).

STUDENTS WITH DISABILITIES: All individuals who are diagnosed with a disability are protected under the Americans with Disabilities Act, and Section 504 of the Rehabilitation Act of 1973. As such, you may be entitled to certain accommodations within this class. If you are diagnosed with a disability, please make an appointment to meet with Accessibility Resources, 133 Milne Library, ext. 2137. All students with the necessary supporting documentation will be provided appropriate accommodations as determined by the Accessibility Resources Office. It is your responsibility to contact Accessibility Resources and concurrently supply me with your accommodation plan, which will inform me exactly what accommodations you are entitled to. You will only receive accommodations once you provide me with an Accessibility Resources accommodation plan. Any previously recorded grades will not be changed.

EMERGENCY EVACUATION PROCEDURES: In the event of an emergency evacuation, classes meeting in this building are directed to reassemble at the IRC Lobby so that all persons can be accounted for. Complete details of the College's emergency evacuation, shelter-in-place and other emergency procedures can be found at the emergency response guidelines⁹. All students are also encouraged to register for NY Alert for immediate notification of emergencies on or near the campus.

ACADEMIC INTEGRITY: You are expected to know and abide by SUNY Oneonta's Academic Integrity Policy¹⁰. Plagiarism in any form—including copying and pasting text from websites or other materials without using quotation marks and/or referring to information without properly crediting sources—will not be tolerated. If you unethically copy the work of another student or outside source, you will receive NO CREDIT for the entire assignment.

⁹ <http://www.oneonta.edu/security>

¹⁰ <http://www.oneonta.edu/development/judicial/code.pdf>