

Course Syllabus – Spring 2022
ENGR 4490/6490 Renewable Energy Engineering

Location: Driftmier Engineering Center, Room-1456

Time: 1.50 to 2.40 pm (MWF)

Course Instructor

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UGA Bulletin Course Description

Basic principles and technical details of various renewable energy technologies (solar, biomass, wind, hydroelectric, geothermal, tidal and wave energy) for the sustainable future. Process design, energy analysis, engineering economics and environmental assessment of renewable energy systems

| <u>Offered</u> | <u>Credits</u> | <u>Level</u> | <u>Weekly Instruction Pattern</u> |
|-----------------------|-----------------------|---------------------|--|
| Spring 2022 | 3 | Split | Three 50 min lectures |

Prerequisites

ENGR 3150 or ENGR 3150E or ENVE 3220
ENGR 3140 or ENGR 3140E or MCHE 3140

Grading system

| | |
|--|-------|
| Class participation & Attendance (via Top hat) | – 5% |
| Assignments | – 25% |
| Top hat quizzes | – 10% |
| Class test – I (Feb. 18, 2022) | – 20% |
| Class test – II (Apr. 08, 2022) | – 20% |
| Comp. Final Exam (May 06, 2022) | – 20% |

Grading system for Graduate Students – ENGR 6490

| | | |
|---------------------|---|-------|
| Exams | } | = 80% |
| Assignments | | |
| Class Participation | | |
| Quiz | | |

Renewable Energy individual Term Project = 20%

Grades

| | |
|----|-----------|
| A | 93.1-100 |
| A- | 90.1-93.0 |
| B+ | 87.1-90.0 |
| B | 83.1-87.0 |
| B- | 80.1-83.0 |
| C+ | 75.1-80.0 |
| C | 70.1-75.0 |
| C- | 65.1-70.0 |
| D | 60.1-65.0 |
| F | 00.0-60.0 |

Students learning outcomes

Upon completion of this course, the students should be able to

1. Recognize the role and importance of renewable energy resources to address climate change and to meet US or global energy demands.
2. Describe the principles of producing energy from renewable energy sources to mitigate climate change.
3. Design renewable energy conversion devices/systems by applying thermodynamic and heat transfer principles
4. Evaluate the performances of renewable energy systems by both experiential and problem-based learning approaches.
5. Apply renewable energy technical expertise by selecting or choosing the best renewable energy technology options in real world situations with given constraints and stakeholder needs.

ABET Program Outcomes (Coverage scale: Basic, Intro & Extensive) for ENGR 4490

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics - **Extensive**
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors - - **Extensive**
3. an ability to communicate effectively with a range of audiences - **Intro**
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts - **Extensive**
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives - **Intro**
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions – **Intro to Extensive**
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies – **Extensive**

Topical outline

1. Introduction
 - 1.1. Environmental impacts of fossil energy use
 - 1.2. Implications of global climate change and GHG emissions
 - 1.3. Climate reverse energy solutions**
 - 1.4. Sustainable/Renewable energy solutions to drawdown**
2. Solar energy
 - 2.1. Solar thermal energy
 - 2.1.1. Solar flat plate collectors
 - 2.1.2. Solar thermal power generation
 - 2.2. Solar photovoltaics
3. Biomass and Bioenergy
 - 3.1. Biomass resources
 - 3.1.1. Feedstock collection, transport methods
 - 3.1.2. Feedstock preprocessing and treatment methods
 - 3.2. Biomass conversion technologies
 - 3.2.1. Thermo-chemical platform
 - 3.2.2. Biological platform
 - 3.3. Recent advances and applications of bioenergy technology
4. Wind energy
5. Geothermal energy
6. Blue energy - ocean wave & tidal energy
7. Latest technologies and advances in renewable energy

Resources:

1. Lecture notes on Renewable Energy Engineering, assignments and other resources will be posted on the course website. (www.elc.uga.edu).
2. TopHat course web link information: In-class response system

Course Name: **ENGR 4490 - Renewable Energy Engineering -Spring 2022 - Join Code: 241410**

Recommended textbooks

1. Solar Engineering of Thermal Processes 2006 by Duffie, J. A. & W. A. Beckman. 3rd ed. John Wiley & Sons, Inc.
2. Renewable Energy Engineering, 2017 by Jenkins, N and Ekanayake, J., Cambridge University Press.

Additional references:

3. RETScreen International. 2021. Users' guide. Natural Resources Canada, Ottawa, Canada.
4. CIGR Handbook of Agricultural Engineering Volume V: Biomass Engineering. ASABE Publications, MN, USA.
5. Tester, J. W., E. M. Drake, M. W. Golay, M. J. Driscoll, W. A. Peters. 2005. Sustainable Energy – Choosing among options. The MIT Press, Cambridge, MA.
6. Boyle, G. 2004. Renewable energy: Power for a sustainable future. Oxford University press, Oxford, UK.
7. Sims, R. 2002. The Brilliance of Bioenergy. James and James Publications, London, UK.
8. Frank Rosillo-Calle, Sarah Hemstock, Peter de Groot and Jeremy Woods. 2006. The Biomass Assessment Handbook, James and James Publications, London, UK.

Assignments

Assignment due date will be specified, when it is assigned. You are encouraged to discuss problems with other students, however, **duplicating another student's work and copying in groups** will be considered as **plagiarism**, and this practice is unacceptable (see Academic Honesty below). **Neatness and clarity** will be important in assigning homework grades. Excused late homework will only be accepted under extreme circumstances (e.g., personal crises). Unexcused late homework will not be given a credit. All completed assignments will be **electronically submitted** as a single document on the course website (www.elc.uga.edu).

Tests and Exam

You may bring pencils, paper, erasers, and calculators to tests and final exam. If necessary, you may be allowed to bring two-page formula sheet. There will be absolutely no sharing of calculators and no talking during test periods. **Testing dates will not be altered**, and "make-up" tests will only be given under extreme circumstances. Use of smart phones and any other electronic devices will be prohibited during tests and final exams.

Academic Honesty

UGA Student Honor Code: "I will be academically honest in all of my academic work and will not tolerate academic dishonesty of others." A Culture of Honesty, the University's policy and procedures for handling cases of suspected dishonesty, can be found at <https://honesty.uga.edu> .

ENGINEERING PROFESSIONALISM POLICY

Engineers make great contributions to society. Engineering is a very satisfying profession that provides many rewards but is demanding and requires hard work. The engineering profession is governed by a code of ethics. The following link will take you to the National Society of Professional Engineers, Engineering Code of Ethics website. <http://www.nspe.org/resources/ethics/code-ethics>. Engineering faculty at UGA expect students to act in a professional manner at all times and develop the work ethic required for a successful engineering career. Engineering students at UGA are responsible for maintaining the highest standards of professionalism and professional practice.

UGA College of Engineering Accreditation

The programs in the UGA College of Engineering are accredited through ABET, a nonprofit, non-governmental organization that accredits college and university programs in the disciplines of applied science, computing, engineering, and engineering technology. ABET accredits over 3,100 programs at more than 670 colleges and universities in 24 countries. *

Earning a degree from an ABET-accredited program:*

- Verifies that the quality of the educational experience you've received meets the standards of the profession.
- Increases and enhances employment opportunities.
- Permits and eases entry to a technical profession through licensure, registration, and certification.
- Establishes eligibility for many federal student loans, grants, and/or scholarships.

An ABET-accredited program assures students that:*

- the institution is committed to improving their educational experience the program is committed to using best practices and innovation in education
- the program is guided by its industry, government, and academic constituents through formal feedback

- the program considers the students' perspective as part of its continuous quality improvement process
- *See more at <http://abet.org/why-accreditation-matters/> from abet.org

Other Responsibilities

Attendance is **mandatory**. A student may be withdrawn from this course by the instructor without notification to the student for excessive absences or for failure to complete necessary prerequisites. For this course, "**excessive absences**" is defined as absences from all of the **first three class meetings or Two (2) or more absences from any contiguous ten (10) scheduled class meetings**. A student may also be withdrawn from this course by the instructor after one warning for disruption of class. Example: **Phone ringing or using a smart phone or similar devices** during the lecture and test hours are strictly prohibited unless the **instructor asks you to use**.

The instructor will provide students with an opportunity to complete academic responsibilities resulting from absences due to (eg.): 1) observation of religious holidays, 2) significant illness, 3) death in family and 4) emergencies. The instructor **requires reasonable written notice of absences** (one week, when possible). Please communicate promptly **in writing (by email)** to instructor such absences, including date and reason for absence, and proposed alternative for academic responsibilities. Failure to communicate with the instructor in a timely fashion may cause the loss of opportunity to complete your **academic responsibilities**.

Mental Health and Wellness Resources:

- If you or someone you know needs assistance, you are encouraged to contact Student Care and Outreach in the Division of Student Affairs at 706-542-7774 or visit <https://sco.uga.edu>. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services.
- UGA has several resources for a student seeking mental health services (<https://www.uhs.uga.edu/bewelluga/bewelluga>) or crisis support (<https://www.uhs.uga.edu/info/emergencies>).
- If you need help managing stress anxiety, relationships, etc., please visit BeWellUGA (<https://www.uhs.uga.edu/bewelluga/bewelluga>) for a list of FREE workshops, classes, mentoring, and health coaching led by licensed clinicians and health educators in the University Health Center.
- Additional resources can be accessed through the UGA App.

COVID-19 related classroom instruction and accommodations

Students seeking an accommodation related to COVID-19 and any other disability related special requests should contact Disability Services at <https://drc.uga.edu/>. As per the UGA guidelines for Spring instruction, the students will participate in face-to-face instruction with appropriate social distancing and safety precautions. On-line instructional accommodation will be provided to students who are pre-approved by DRC and self-quarantined due to COVID-19 exposure/symptoms. The instructor will honor and accommodate all pre-approved disability and other special accommodations by UGA disability Services.

All students are required to self-monitor and report COVID-19 related symptoms using a dawgcheck UGA app (<https://dawgcheck.uga.edu/>) and wear face masks at all time while inside the classroom and any campus facilities/buildings. If you have additional questions and/or looking for COVID-19 related information, please visit the website at <https://coronavirus.uga.edu/information-for/students/>