NORTH CAROLINA STATE UNIVERSITY ELECTRICAL AND COMPUTER ENGINEERING

ECE 552: Electric Power Generation: Conventional & Renewable

**Instructors:** Drs. Mesut Baran, Stephen Terry, Joe DeCarolis Phone: 515-5081, Email: baran@ncsu.edu

**Prerequisites**: ECE 305 or equivalent

**Course Outline**

This course focuses on the electric power generation. Conventional heat engine based techniques as well as the new renewable energy based electric energy generation technologies will be introduced. The principals of main renewable electric energy systems (REES) -solar, wind, and fuel cells- will be covered. Economic and environmental aspects of the electric power generation will also be discussed.

The course outline is as follows:

1. Overview of Electric Power System (Ch1)
2. Conventional Electric Power Generation

. Fundamentals of Heat Engines

. Thermal Power Plants

1. Economics of Distributed Resources (Ch1.6 & Appx A)
2. Photovoltaic (PV) Systems (Ch 4-6)
	1. Solar resource (selected topics from Chapter 4)
	2. PV cell physics, technologies, and electrical models (Ch 5)
	3. PV systems (Ch 6)
3. Wind Power Systems (Ch 7)

Wind resource, wind turbines, with emphasis on electrical components including generators,

3-phase power electronics, and interface to the grid.

1. Distributed Generation (Ch 9)

Fuel Cells, Hydro Power, Electricity Storage

1. Environmental Impacts of Electric Power Generation

**Textbook**: G. M. Masters, *Renewable and Efficient Electric Power Systems*, Wiley 2013 (softcopy is available via library)

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| **Grading** : | Homework | 20% |
|  | Term Proj. | 20% |
|  | Exam | 30% |
|  | Final | 30% |

University Standard grading scale will be used to assign the letter grade based on class total.

**INCOMPLETE GRADE**

In order to get an extension for an incomplete grade, students having unexpected difficulties that prevent them

completing course requirements need to document their situation and discuss their case with the instructor. The

university policy on incomplete grades is located at [http://www.ncsu.edu/policies/academic\_affairs/grades\_undergrad/REG02.50.3.php.](http://www.ncsu.edu/policies/academic_affairs/grades_undergrad/REG02.50.3.php)

Student should complete the missing work that is required for the incomplete grade within the deadline given. In case the student misses the deadline, the course grade will be given based on the work that has been completed. If an extended deadline is not authorized by the instructor or department, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student.

**ATTENDANCE**

Attending the class regularly is required. Students should notify the instructor if she/he will miss the class. The

instructor will keep track of attendance and this attendance record will be taken into account in grading, especially in border line cases.

**Software:**

Matlab/Simulink will be used for some of the homework assignments.

For the project a professional software will be used.

**HOMEWORK**

There will be 6-7 homework assignments which will be assigned as appropriate material is covered in the lectures.

Homework will be posted on the course locker with the due dates. Only the University approved reasons will be accepted for late homework (See <http://www.ncsu.edu/policies/academic_affairs/pols_regs/REG205.00.4.php>).

The exam will be after completion of the core concepts of renewable energy systems. Only

**Exam**

the University approved reasons will be accepted for missing an Exam (See <http://www.ncsu.edu/policies/academic_affairs/pols_regs/REG205.00.4.php>).

A make-up exam will be administered at the mutual convenience of the student and the Instructor. In all cases, signed documentation must be provided to the Instructor to determine eligibility for the make-up exam.

**CLASS PROJECT**

The project will be team based. The goal of the project is to design a REES for a given application.

Team will prepare a written report and submit it with the supporting documents.

**ACADEMIC INTEGRITY**

Work in this course is to be done under the Academic Integrity Honor Pledge:

"I have neither given nor received unauthorized aid on this test or assignment." Students must abide by the Code of Student Conduct articulated at: <http://www.ncsu.edu/policies/student_services/student_discipline/POL11.35.1.php>

Evidence of copying, including copying of source code, or any other use of unauthorized aid will be investigated and potentially referred to the University judicial system as a violation of the **Code of Student Conduct**. The *minimum sanction* for a violation is a zero on an assignment. Recycling of projects from another resource will be considered an academic integrity violation.

**STUDENTS WITH DISABILITIES**

Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of

available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students with disabilities, please see this page [(http://www.ncsu.edu/provost/hat/current/appendix/appen\_k.html](http://www.ncsu.edu/provost/hat/current/appendix/appen_k.html).)

**ANTI-DISCRIMINATION**

NC State’s policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://www.ncsu.edu/policies/campus_environ>or [http://www.ncsu.edu/equal\_op.](http://www.ncsu.edu/equal_op) Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 515-3148.”

**Health and Well-Being Resources**

 As a student you may experience a range of personal issues that can impede learning, such as strained relationships,
increased anxiety, alcohol/drug concerns, feeling down, difficulty concentrating and/or lack of motivation. These
mental health concerns or stressful events may lead to diminished academic performance and may impact your
ability to participate in daily activities.

It is very important that you have a support system and that you ask for
help when you are struggling. The Counseling Center at NC State offers confidential mental health services for
full time NC State students, including same-day emergency services. Please visit https://counseling.dasa.ncsu.edu/
to get connected.

* Counseling Center ([NCSU Counseling Center](https://counseling.dasa.ncsu.edu/))
* Health Center ([Health Services | Student](https://healthypack.dasa.ncsu.edu/))
* If the personal behavior of a classmate concerns or worries you, either for the classmate’s well-being or yours, we encourage you to report this behavior to the NC State CARES team:  ([Share a Concern](https://cm.maxient.com/reportingform.php?NCStateUniv&layout_id=2)).

If you or someone you know are experiencing food, housing or financial insecurity, please see the Pack Essentials Program ([Pack Essentials](https://dasa.ncsu.edu/pack-essentials/)).

**Other Important Resources**

* **Keep Learning:** [Keep Learning](https://dasa.ncsu.edu/students/keep-learning/)
* **Protect the Pack FAQs:** [Frequently Asked Questions | Protect the Pack](https://www.ncsu.edu/coronavirus/frequently-asked-questions/)
* **NC State Protect the Pack Resources for Students:** [Resources for Students | Protect the Pack](https://www.ncsu.edu/coronavirus/reactivating-campus/resources-for-students/)
* **NC State Keep Learning, tips for students opting to take courses remotely:**[Keep Learning Tips for Remote Learning](https://dasa.ncsu.edu/academics/keep-learning/strategies-for-success/)
* **Introduction to Zoom for students:**<https://youtu.be/5LbPzzPbYEw>
* **Learning with Moodle, a student’s guide to using Moodle:**<https://moodle-projects.wolfware.ncsu.edu/course/view.php?id=226>
* **NC State Libraries** [Technology Lending Program](https://www.lib.ncsu.edu/devices)

**EOL Students**

1. Homework:

You can turn in your assignments and/or projects by uploading it to course locker (preferred). The submission should not postdate the announced deadline.

1. Exams

All exams are to be proctored UNLESS they are take-home exams. Both the exam and the final will be in-class-type exams, so please submit your proctor identification form to EOL office. Contact EOL office concerning the exam process. Finally, note that if the proctor has not been approved, you will not be allowed to take the exam.

**The exams should be taken on the same day it is scheduled. If the proctor is not available on that day, you will have the next day window to schedule a time with the proctor.**

SPRING 2022 Additional Info

The following information was created by the Associate Deans of Academic Affairs, DELTA, the Registrar’s office, and NC State Libraries.

Due to the COVID-19 pandemic, public health measures continue to be implemented across campus.  Students should stay current with these practices and expectations through the [Protect the Pack](https://www.ncsu.edu/coronavirus/) website (<https://www.ncsu.edu/coronavirus/>). The sections below provide expectations and conduct related to COVID-19 issues.

**Community Standards related to COVID-19**

We are all responsible for protecting ourselves and our community.  Please see the [community standards](https://www.ncsu.edu/coronavirus/reactivating-campus/community-standards/?utm_source=ALL+STAFF%2FFACULTY%2FSTUDENTS+-+UCOMM&utm_campaign=0d221175c9-EMAIL_CAMPAIGN_72820_Community_Standards&utm_medium=email&utm_term=0_e7a0fd0c9f-0d221175c9-92460566) and Rule 04.21.01 regarding Personal Safety Requirements Related to COVID-19  [RUL 04.21.01 – Personal Safety Requirements Related to COVID-19 – Policies, Regulations & Rules](https://policies.ncsu.edu/rule/rul-04-21-01/)

**Course Expectations Related to COVID-19**:

* **Face Coverings:** All members of the NC State academic community are expected to follow all university policies and guidelines, including the [Personal Safety Rule](https://policies.ncsu.edu/rule/rul-04-21-01/) and [community standards](https://www.ncsu.edu/coronavirus/reactivating-campus/community-standards/?utm_source=ALL+STAFF%2FFACULTY%2FSTUDENTS+-+UCOMM&utm_campaign=0d221175c9-EMAIL_CAMPAIGN_72820_Community_Standards&utm_medium=email&utm_term=0_e7a0fd0c9f-0d221175c9-92460566), for the use of face coverings.
* **Course Attendance**: NC State attendance policies can be found at:  [REG 02.20.03 – Attendance Regulations – Policies, Regulations & Rules](https://policies.ncsu.edu/regulation/reg-02-20-03-attendance-regulations/).  Please refer to the course’s attendance, absence, and deadline policies for additional details. If you are quarantined or otherwise need to miss class because you have been advised that you may have been exposed to COVID-19, you should not be penalized regarding attendance or class participation. However, you will be expected to develop a plan to keep up with your coursework during any such absences.  If you become ill with COVID-19, you should follow the steps outlined in the health and participation section above.
* **Technology Requirements:** This course may require particular technologies to complete coursework.  Be sure to review the syllabus for these expectations, and see the [syllabus technical requirements](https://go.ncsu.edu/syllabus-tech-requirements) for your course. If you need access to additional technological support, please contact  the Libraries’ Technology Lending Service:  ([Technology Lending](https://www.lib.ncsu.edu/devices)).

**Health and Participation in Class**

We are most concerned about your health and the health of your classmates and instructors/TAs.

* If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, you should not attend any face-to-face (F2F) classes or face-to-face component of a hybrid class. Work with your instructor on any adjustments necessary; also follow other university guidelines, including self reporting ([Coronavirus Self Reporting](https://healthypack.dasa.ncsu.edu/coronavirus/)):  Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.
* If you feel unwell, even if you have not been knowingly exposed to COVID-19, please do not come to a F2F class or activity.
* If you are in quarantine, have been notified that you may have been exposed to COVID-19, or have a personal or family situation related to COVID-19 that prevents you from attending this course in person (or synchronously), please connect with your instructor to make alternative plans, as necessary.
* If you need to make a request for an academic consideration related to COVID-19, such as a discussion about possible options for remote learning, please talk with your instructor.

**Health and Well-Being Resources**

These are difficult times, and academic and personal stress are natural results. Everyone is encouraged to [take care of themselves](https://counseling.dasa.ncsu.edu/resources/self-help-resources/self-care/) and their peers. If you need additional support, there are many resources on campus to help you:

* Counseling Center ([NCSU Counseling Center](https://counseling.dasa.ncsu.edu/))
* Student Health Services ([Health Services | Student](https://healthypack.dasa.ncsu.edu/))
* If the personal behavior of a classmate concerns or worries you, either for the classmate’s well-being or yours, we encourage you to report this behavior to the NC State CARES team:  ([Share a Concern](https://cm.maxient.com/reportingform.php?NCStateUniv&layout_id=2)).
* If you or someone you know are experiencing food, housing or financial insecurity, please see the Pack Essentials Program ([Pack Essentials](https://dasa.ncsu.edu/pack-essentials/)).

**Course Delivery Changes Related to COVID-19**

Please be aware that the situation regarding COVID-19 is frequently changing, and the delivery mode of this course could change accordingly, including from in-person to remote.  Regardless of the delivery method, we will strive to provide a high-quality learning experience.

**NO LONGER AVAILABLE - Grading/Scheduling Changing Options Related to COVID-19**

Two policies, enhanced S/U Grading Option and Late Drop, put in place at the beginning of the COVID-19 pandemic have been discontinued.

In some cases, an option may be to request an “incomplete” in the course. If you are experiencing difficult or extenuating circumstances, you should discuss possible options with your instructor and your academic advisor.

**Need Help?**

If you find yourself in a place where you need help, academically or otherwise, please review these [Step-by-Step Help Topics](https://dasa.ncsu.edu/step-by-step-help-topics/). In addition, the following College of Engineering individuals are very available to assist students with any matter, please reach out to them:

 -Dr. Laura Bottomley, Women and Minority Engineering Program, laurab@ncsu.edu

 -Ms. Angelitha Daniel, Women and Minority Engineering Program, aldaniel@ncsu.edu

 -Dr. David Parish, COE Assistant Dean, dwparish@ncsu.edu

 -Dr. Jerome Lavelle, COE Associate Dean, jplavell@ncsu.edu

**Other Important Resources**

* **Keep Learning:** [Keep Learning](https://dasa.ncsu.edu/students/keep-learning/)
* **Protect the Pack FAQs:** [Frequently Asked Questions | Protect the Pack](https://www.ncsu.edu/coronavirus/frequently-asked-questions/)
* **NC State Protect the Pack Resources for Students:** [Resources for Students | Protect the Pack](https://www.ncsu.edu/coronavirus/reactivating-campus/resources-for-students/)
* **Academic Success Center** (tutoring, drop in advising, career and wellness advising): [Academic Success Center](https://asc.dasa.ncsu.edu).
* **NC State Keep Learning, tips for students opting to take courses remotely:**[Keep Learning Tips for Remote Learning](https://dasa.ncsu.edu/academics/keep-learning/strategies-for-success/)
* **Introduction to Zoom for students:**<https://youtu.be/5LbPzzPbYEw>
* **Learning with Moodle, a student’s guide to using Moodle:**<https://moodle-projects.wolfware.ncsu.edu/course/view.php?id=226>
* **NC State Libraries** [Technology Lending Program](https://www.lib.ncsu.edu/devices)