Instructors: Seungdeog Choi
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Office: Simrall 411 and WebEx

Office Hours: Office Hours: TTh: 9:15 AM ~ 10:00 AM
In-person in Simrall or virtually in WebEx
Other hours available through appointment

Lecture Time: TTh: 08:00 AM - 09:15 AM
If class goes online, the lecture video will be uploaded to CANVAS by 08:00 AM at scheduled class time and date.

Lecture room: SIMRAL 106 (Starkville) or Online

Online Section: Lecture is asynchronous – Videos available on through BCOE Distance Site

Prerequisites: Grade of C or better in both ECE 3614 and ECE 3424 or equivalent
Corequisites: or consent of instructor

Textbook: (Required) Power Electronics, by Daniel W. Hart, First Edition, McGraw-Hill, 2011.
(Recommended) Power Electronics: Converters, Applications, and Design / Edition 3 by Ned Mohan, Tore M. Undeland, William P. Robbins

Website: canvas.msstate.edu

Course Description and Objectives

The objective of this course is to introduce students power electronic circuits, with emphasis on the design and analysis of power semiconductor converters including rectifiers and DC-DC converters.

After successfully completing this course, the students will be able to:

Students are expected to understand and analyze how the electronics system operates. Mathematically analyze the operation and design of rectifiers and DC-DC converters. Apply new knowledge in understanding industry power electronics and energy system innovations.

Lecture topics (45 hours contract)

- Introduction (5 hours)
  - Various examples in each section.
- Power Computation (10 hours)
  - Inductor and capacitors
  - Energy recovery
  - Effective values of multiple signals
  - Apparent power and power factors
  - Power computation
- Half Wave Rectifiers (10 hours)
  - Resistive load
  - RL source load
  - Inductor source load
  - Free wheeling diode
  - Half wave rectifier with capacitor filter
  - Controlled half wave rectifier

- Full Wave Rectifiers (10 hours)
  - Single phase full wave rectifier
  - Controlled full wave rectifier
  - Three phase rectifier
- DC DC Converters (10 hours)
  - Buck converters
  - Boost converters
  - Buck boost converter
  - Cuk converters
  - Interleaved converters

Methods of Evaluation and Standards of Achievement

Types of graded assignments include:

(a) **Tests** – there will be three tests during the semester after completion of each major topic. These tests are held during class hours (or university examination schedule). Online and coast students are expected to take the exam **within 1 week** as the on-campus exam is scheduled. If it will be the final exam, they are expected to take exam, at least, **two business days before** the university final grades due. The test dates will be distributed on the first day of class with any changes announced with a minimum of one-week notice.

(b) **Homework –** assigned continuously throughout the semester through CANVAS

(c) **Quizzes –** assigned continuously throughout the semester.

A note on proctors (for Distance and Coat students (if needed)):

- A proctor is required for each exam. The proctor must be approved at least two weeks prior to the exam via submission of a Distance-Education Proctor Approval Form. If the same proctor is used for multiple exams, multiple forms need not be submitted.
- For coast students, if the university provides proctor service for all classes, there is no need for individual approval. However, if proctor service is not provided on the coast campus, each student should individually get approval following the same procedure as a distance student.
- Online students can also take the exam through Webex or any other online tools. This need approval from the instructor in advance.

Undergraduate student (4000 level)

Grading: Test #1 25%
Test #2 25%
Test #3 25%

On campus (Starkville) students
Small quiz and 4%
Class participation 1%
Homework quiz 20%

Online or *Coast* students
Small quiz and 5%
Class participation 0%
Homework quiz 20%

Scale:

Final average	Minimum grade
> 89%	A
> 79%	B
> 69%	C
> 59%	D
=< 59%	F

A graduate student (6000 level): Graduate students must satisfy course requirement beyond undergraduate

Grading: Test #1 25%
Test #2 25%
Test #3 25%
On campus (Starkville) students
Small quiz and 4%
Class participation 1%
Homework quiz 20%
Online or *Coast* students
Small quiz and 5%
Class participation 0%
Homework quiz 20%

Scale **#1**:

Final average	Minimum grade
> 90%	A
> 80%	B
> 70%	C
> 60%	D
=< 60%	F

Scale **#2**:

Final average	Minimum grade
> 89%	A
> 79%	B
> 69%	C
> 59%	D
=< 59%	F

Choose Scale #1 or Scale #2 **until** the first due date of homework (cannot be changed later).

- **S**cale **#1**: Without additional simulation assignments in each homework.
- **S**cale **#2**: With additional simulation assignments in each homework (*highly recommended*).
- **Each** simulation assignment # will be counted as one additional **H**omework quiz in grading.

Graduate students can choose between two different grading scales. If graduate students choose to not complete simulation assignments (similar to undergraduates), then Scale #2 is applied (this will be non-trivial due to graduate-only exam problems). If graduate students choose to use the same scale (Scale #2) as the undergraduates, then they must complete additional simulation homework assignments.

Tentative Test Plan:

- Test #1: **Tuesday, Sept. 24th** (regular class time);
- Test #2: **Tuesday, Oct. 29th** (regular class time);
- Test #3: **Wednesday, Dec. 11th,** 2024, (8:00 AM to 11:00 AM, University final exam schedule);

  Plan ahead to avoid any conflicts with these three important dates.

CLASS INFORMATION

Expectations for the Classroom and Communication

The following policies for course communication apply for **ALL students**:

- You are required to check your MSU email account regularly. This is considered an official means of communication by MSU for online education students.
- The course materials will be accessed through Canvas.
- All class announcements will be posted on the Canvas website.
- Assignment submissions will utilize Canvas unless otherwis e specified by the instructor.
- If you are online and coast student, you are required to have access to a computer that connects to the internet.
- Students should direct correspondence to the instructor directly related to the class via the mail feature in Canvas.
- Students should not discuss specific exam questions.
- Students are encouraged to discuss homework together in a group, but the assignment should be completed individually.

- Email to the instructor must be sent from your official MSU email account (@msstate.edu).

The following policies for course communication apply to **students enrolled in the Online and Coast section**:

- Faculty office hours will be hosted in WebEx. Students can join using a computer or smartphone app.
- Students can correspond with each other via the general course discussion board. Please note that collaboration on individual assignments is not acceptable.
- Students should expect to log in to Canvas no less than 3 times per week to access course information, lectures, and updates.
- Please send an email for a phone or online appointment.

Grading Policies

Instructor-provided class materials are the only resources allowed while taking quizzes. ***All quizzes, homework, and exams are INDIVIDUAL assignments. If you share quiz questions, copy another student's work, or allow another student to copy your work, then you are guilty of academic dishonesty****.*

Students shall not bring or have any computing equipment in the exam (except calculator), including mobile phones, books, dictionaries, electronic organizers, notes or paper, and other materials as shall be authorized by the professor.

Test Policies:

- Students can use **one** formula sheet while completing exams. Quiz and homework problems are not allowed in the formular sheet. Minimum 50% exam problems will be similar to quiz, in-class examples, and home-works.

Quiz Policies:

- **Small Quiz** (S_quiz) will be continuously given directly during class.
- **Homework quiz** (H_quiz) will be provided about every two weeks on the concepts from the assigned homework.
- H_Quiz is not an open book. Equation sheets are not allowed.
- Online and coast students do not need a proctor for S_quiz and H_quiz.
- Online and coast students should prepare papers before the start of any classes to take S_Quiz and H_quiz. S_quiz might need three pages, and H_quiz might need three pages of papers, assuming A4 size. Online and coast students must scan the S_quiz and H_Quiz and submit through CANVAS (find assignment tab in CANVAS) **within 1 week** of the scheduled class to receive a grade. Please submit combined pdf file. Late submission or email submission will not be accepted.
- Starkville campus students do not need to prepare papers. Blank papers will be provided. The first page should display quiz date, your name, and net_ID. Student should submit the quiz sheet right after the class. Late submission or email submission will not be accepted.

  Always bring engineering calculator to the class to take quiz.

Class participation policy:

- Students are expected to ask questions (expected at least one question in every four classes on average) directly during the class to receive up to 0.5% grade out of 1% grade. Students are expected to actively participate in the class to receive 1% of the grade. Online or coast students are not required but strongly recommended to send emails for questions.

Makeup Exam / Quiz Policy:

- The student will be given "makeup opportunity" if there was an excused absence on exam/quiz date (university policy: AOP 12.09). The student will be also given "makeup opportunity" if the student has informed the instructor **within 24 hours of the student's return to campus**.

Homework and Other Policies:

- Basic lecture notes will be available in the CANVAS through the announcement page. Please print and bring it to the class. The lecture note in the CANVAS is not complete but will be an effective guide for your study during the class.
- Homework will be regularly assigned through CANVAS. However, you do not have to submit homework in this class.
- Solve all of the homework problems and be sure that you understand them. There will be H_quiz about every two week from the concept of assigned homework.

Simulation Homework (if you are taking 6000 level and selected Scale #2 in grading)

- For simulation, use any software including free one (e.g., LT spice), university software (e.g., Matlab or PSpice), commercial ones (e.g., PSIM if available), or any other equivalent circuit simulator. Submit the simulation by the due date of each homework through CANVAS.
- Late submission or email submission will not be accepted.

Electronic Device Policy

- During fac-to-face lecture, all cell phones and pagers must be turned off to avoid interruptions that prevent other students from concentrating on the material presented and laptops and tablets are not allowed.
- Please always bring a calculator to take a quiz and exam. FYI, the quiz will be continuously provided.

Minimum Technology Requirements

The following minimum technology requirements are necessary **for all students** to complete the course:

- Computer with web browser, Microsoft Office, and Adobe Reader
- Internet access

Online and coast students will also need:

- Webcam and microphone (computer or smartphone) to upload video responses to assignments or participate in virtual lab meetings / office hours.
- Video recording and editing software (Camtasia is available to download free from MSU ITS)

Technical Assistance

If you have questions about this course, please contact the instructor via Canvas messaging. For technical support (e.g., computer support, Canvas issues), please contact help@ece.msstate.edu or engr-dist-support@lists.msstated.edu or www.bagley.msstate.edu/distance.

Attendance Policy

Please refer Academic Operating policy 12.09. (http://www.policies.msstate.edu/policypdfs/1209.pdfLinks to an external site.), regarding attendance expectations and accommodations. Note that official, university-approved and documented absences are not subjected to attendance penalties. It is the student's responsibility to initiate a

request of making up course work in a timely manner. Unless impractical, all communication regarding official, university-approved and documented absences and make-up work should take place prior to the absence.

Attendance Policy for online instruction

Online students are expected to "attend" every class meeting by watching assigned lecture videos and reading assigned material. Both lecture and lab meetings are asynchronous, which means you can "attend" (e.g., watch videos) at a time convenient for your weekly schedule. However, you must attend class and turn in assignments according to the weekly class schedule and assignment due dates.

Copyright

Copyrighted materials within the course are only for the use of students enrolled in the course for purposes associated with this course and may not be retained or further disseminated. Course materials must not be posted on any website or added to any database without the instructor's written permission. Do not distribute test problems, homework, or any other materials. Do not post course materials on websites such as chegg.com, slader.com, etc. Violations of this policy will be referred to the Honor Court.

ChatGPT and use of AI

Generally, students are NOT permitted to use generative AI tools such as ChatGPT for assignments except those authorized specifically by their instructor in the assignment directions. The unauthorized use of a generative AI tool to complete an assignment constitutes academic dishonesty and may be reported as an Honor Code violation. All submitted work will be filtered through Turnitin's AI writing detection tool, and other screeners may also be used.

For assignments in which generative AI has been explicitly permitted by your instructor, students must give credit and cite any AI-generated material according to citation-specific rules (e.g., IEEE style), including in-text citations, quotations, and references. Any work with more than the allowable percentage of AI-generated material specified in the assignment instructions, if applicable, could be reported as an Honor Code violation. Students must also include the following statement in assignments to indicate use of a generative AI tool: "The author(s) acknowledges the use of [Tool Name] in the preparation of this assignment for [brainstorming, grammatical correction, citation, etc.]." Failure to acknowledge use of generative AI could be reported as an Honor Code violation.

UNIVERSITY POLICIES

MSU Syllabus via Canvas

The Mississippi State University Syllabus contains all policies and procedures that are applicable to every course on campus and online. The policies in the University Syllabus describe the official policies of the University and will take precedence over those found elsewhere. It is the student's responsibility to read and be familiar with every policy. The University Syllabus may be accessed at any time on the Provost website under Faculty and Student Resources and at https://www.provost.msstate.edu/faculty-student-resources/university-syllabus

LECTURE TOPICS

Week	Date	Topic / Event
1	Aug. 22	Introduction
	Aug. 27	Power Computation,
2	Aug. 29	Power Computation
	Sept. 3	Half Wave Rectifiers,
3	Sept. 5	Half Wave Rectifiers, **H Quiz**
	Sept. 10	Half Wave Rectifiers,
4	Sept. 12	Half Wave Rectifiers
	Sept. 17	Half Wave Rectifiers,
5	Sept. 19	Review and **H_Quiz**
	Sept. 24	**Test #1**
6	Sept. 26	Full Wave Rectifiers
	Oct. 1	Full Wave Rectifiers,
7	Oct. 3	Full Wave Rectifiers
	Oct. 8	Full Wave Rectifiers, **H_Quiz**
8	**Oct. 10**	**NO CLASS (Fall Break)**
	Oct. 15	Full Wave Rectifiers,
9	Oct. 17	Full Wave Rectifiers
	Oct. 22	Full Wave Rectifiers,
10	Oct. 24	Review and **H_Quiz**
	Oct. 29	**Test #2**
11	Oct. 31	DC DC Converters,
	Nov. 5	DC DC Converters,
12	Nov. 7	DC DC Converters,
	Nov. 12	DC DC Converters, **H_Quiz**
13	Nov. 14	DC DC Converters,
	Nov. 19	DC DC Converters,
14	Nov. 21	DC DC Converters, **H_Quiz**
	Nov. 26	DC DC Converters,
15	**Nov. 28**	**NO CLASS (Thanksgiving holiday)**
	Dec. 3	Evaluation, Review, and **H_Quiz**.
Exam Wk	**Dec. 11**	**Test #3**