

The University of Texas at Tyler  
Department of Electrical Engineering

**EENG 4317 & EENG 5317 –Power Electronics (Elective)**

**Syllabus**

**Catalog Description:**

The use of solid-state components in power systems; rectifying devices; diode circuits and rectifiers; controlled rectifier circuits; AC voltage controllers; Thyristor commutation techniques; DC choppers; speed torque characteristics of motors and loads; starting, braking and transient analysis of electric motors; introduction to HVDC. Three hours of lecture per week. Prerequisites: EENG 4309. **Prerequisite or Co-requisite:** EENG 4310.

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**Credits:** 3 ( 3 hours lecture, 0 hours laboratory per week )

**Text(s):** M. H. Rashid, Power Electronics: Circuits, Devices, and Applications, Prentice Hall, 2011.

**Additional Material:** Instructor's Lecture Notes

**Course Coordinator:** Kazi Rashed

**Topics Covered:** (paragraph of topics separated by semicolons)

Introduction to Power Electronics  
Diode Circuits and Rectifiers  
Thyristors and Converters  
Controlled Rectifiers  
AC Voltage Controllers  
Thyristor Commutation Techniques  
DC Choppers  
PWM Inverters  
Static Switches  
Power Supplies  
DC Drives  
AC Drives  
Introduction to HVDC

**Evaluation Methods: (only items in dark print apply):**

1. Examinations / Quizzes
2. Homework
3. Report
4. Computer Programming
5. Project
6. Presentation
7. Course Participation

## 8. Peer Review

**Course Objectives<sup>1</sup>:** By the end of this course students will be able to:

1. Analyze uncontrolled rectifier circuits [1,5]
2. Analyze and design (conceptual) diode circuits and rectifiers [1,5]
3. Analyze and design (conceptual) single-phase controlled rectifier circuits (converters) [1,5]
4. Analyze three-phase controlled rectifier circuits [1,5]
5. Analyze AC Voltage Controllers and static switches [1,5]
6. Analyze DC choppers [1,5]
7. Analyze simple AC and DC drives controllers [1,4,5]

<sup>1</sup>Numbers in brackets refer to method(s) used to evaluate the course objective.

**Relationship to Student Outcomes (only items in dark print apply)<sup>2</sup>:** This course supports the following Electrical Engineering Student Outcomes, which state that our students will possess:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. [1]
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. [2,3,4]
3. an ability to communicate effectively with a range of audiences [1,3,8]
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. [13,14]
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. [7]
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions [1-8]
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. [5,6]

<sup>2</sup>Numbers in brackets refer to course objective(s) that address the Program Outcome.

**Contribution to Meeting Professional Component: (in semester hours)**

Mathematics and Basic Sciences:	0	hours
Engineering Sciences and Design:	3.0	hours
General Education Component:	0	hours

**Prepared By:** Hassan El-Kishky

**Date:** 01/14/2011

Revised 01/21/13

01/14/14

01/18/2016

01/07/2017

05/28/2020

EENG 4317 & EENG 5317

## Power Electronics Outline

Kazi Rashed  
krashed@uttyler.edu

**Time:** 9:30 – 10:50 AM, TR

**Place:** TBA

**Text:** M. H. Rashid, Power Electronics: Circuits, Devices, and Applications, Prentice Hall, 2004

**Office Hours:** 11:00-12:30pm **MW**  
Other times by appointment

**Software:** Matlab®, Multisim

**Contents:**

Intro to Power Electronics 1-Phase Uncontrolled Rectifier Circuits 3-phase Uncontrolled Rectifier Circuits Effect of Source Inductance Power Quality and Transformer Utilization Factor Energy Recovery Techniques	3 W
1-Phase Full Converters (Controlled Rectifier Circuits) 1-Phase Semi-Converters 3-Phase Full Converters 3-phase Semi-Converters Effect of Source Inductance 1-phase and 3-phase inverters <b>Applications-DC Motor Speed Control</b>	3 W
1-Phase AC Voltage Controllers 3-Phase AC Voltage Controllers <b>Applications-Heating</b> <b>Applications-Induction Motor Speed Control</b>	3 W
Thyristor Commutation Techniques DC-DC Choppers Type A DC-DC Choppers Type B 4-Quadrant DC-DC Choppers	3 W
<b>Matlab Simulation of Power electronics Devices, Circuits, and Systems-Project</b>	1 W
<b>Design and Characterization of 3-Phase IM Speed Controller-Final project</b>	2 W
Final Exam	1 W

**Grading:**

<b>Homework assignments</b>	<b>10%</b>
<b>Simulation projects (2)</b>	<b>10%</b>
<b>Final Project (comprehensive)</b>	<b>20%</b>
<b>Midterm Exam</b>	<b>30%</b>
<b>Final Exam</b>	<b>30%</b>

## Homework and Project Policy:

- All homework assignments must be provided with a cover sheet.
- All projects must be produced and sent electronically to the instructor.
- No late assignments are accepted without prior approval of the instructor.
- All assignments must be turned in to get a passing grade.
- At the end of the semester, you are required to turn in your course folder with all of your course materials to the instructor.

## Mode of Delivery:

Hybrid Model. The semester will begin with synchronous zoom classes. Students are expected to login through zoom to attend the lectures. At the end of each class, the recorded lectures will be posted in Canvas. After Mid-Term Exam, the mode of delivery will be reevaluated. If the student has any concerns or would like to share their feedback on the lectures, email the Instructor anytime.

## Flexible Online Office Hours:

This course will have extended office hours. Students can meet with the Instructor during the office hours (Office hours TBD) using the course zoom link. However, if students are not available during the mentioned office hours, they are strongly encouraged to schedule a meeting with the Instructor anytime.

## Computer Equipment Policy:

In order to take this class, integrated laboratory sessions and quizzes/exams, you will need the following items as specified below:

- Windows 10 Computer or Mac running Windows virtualization software
- High-speed Internet connection
- Webcam (internal or external)
- NI Multisim software

Type	Minimum	Recommended
Web Camera	640×480 resolution	1280×720 resolution
PC Users	Windows Vista	Windows 10 (10 S is not supported)
Mac Users	OS X 10.5 or higher	OS X 10.13 High Sierra
Internet Download Speed	.768 Mbps	1.5 Mbps
Internet Upload Speed	.384 Mbps	1 Mbps
RAM	1024 MB	2 GB
Ports	1935, 843, 80, 443, 61613, UDP/TCP	1935, 843, 80, 443, 61613, UDP/TCP

## Homework:

There will be a total of 3 assignments. Homeworks will be in the form of problems, theory questions, and a take home quiz to test the understanding of basic concepts. Homework will be assigned by Monday as per the schedule and will be due on Friday of the following week. No late homework will be accepted. Homework problems/ questions may be discussed with other students, but the final submission should be an original and independent solution.

**Exam:**

This course will have MidTerm and Final exam. The MidTerm exam will have 30% weightage and Final exam will have a 30% weightage.

**Academic Integrity:**

Students should be aware that absolute academic integrity is expected of every student in all undertakings at the University of Texas at Tyler. A plagiarism check will be done all the reports submitted by students. Copied or unoriginal solutions will result in a "0" in that course component. An evidence of a pattern in academic dishonesty will lead to strong university-imposed penalties.

**Attendance:**

Attendance will be 5% weightage.

**Academic Integrity:**

Students should be aware that absolute academic integrity is expected of every student in all undertakings at The University of Texas at Tyler. Failure to comply can result in strong university-imposed penalties. **All project reports and assignments will be verified using plagiarism checking software and violations will result in a grade of zero for the lab report or assignment at a minimum, and possibly stronger penalties such as a failing grade in the course and a scholastic dishonesty report submitted to the university.**

**Proctoring**

The assessments in this online course will be proctored using ProctorU or two-way interactive Zoom sessions. Beyond the cost of initial equipment needed (e.g. a camera for your computer), there will not be any additional cost for proctoring. You will need to create a ProctorU account and install the ProctorU extension before attempting any assessment.

To create a ProctorU account, follow the ProctorU tool within Canvas. Please make sure you are using the current version of Chrome or Firefox and download the ProctorU extension available at <http://bit.ly/proctoruchrome> or <https://www.proctoru.com/firefox>.

In order to use ProctorU, you will need the following:

- High-speed Internet connection
- Webcam (internal or external)
- Windows, Mac, or Chrome Operating System
- Up-to-date Chrome or Firefox browser and ProctorU extension installed
- Valid photo ID
- Quiet environment to take your assessment

You can visit the Test Taker Resource Page for additional information at <https://bit.ly/ProctorMe>

**Accommodation:**

If you have a disability, including a learning disability, for which you request disability support services/accommodation(s), please contact the Disability Support Services office, so that the appropriate arrangements may be made. In accordance with the Federal Law, a student requesting disability support services/accommodation(s) must provide appropriate documentation of his/her disability to the Disability Support Services Counselor. For more information, call or visit the Student Accessibility and Resources Center located in the University Center, Room 3150. The Telephone number is

903.566.7079. Additional information may also be obtained at the following UT Tyler website: <https://www.uttyler.edu/disabilityservices/>

### **How to be Successful in this course:**

The main focus of the Instructor is to help students learn the significant VLSI concepts. Some of the ways to be successful in this course are:

- Attend all the lectures during the class meeting time. Though the lectures will be recorded and published in Canvas, attending the live classes will help the students to interact with the Instructor and clarify their questions.
- Follow the deadlines. The course has homework, projects and 2 exams and reading assignment for assessment (for graduate students) . Each of these have a weightage in the overall grade.
- Avoid plagiarism. In the event of any plagiarism, the particular assignment will not be graded resulting in "0". Its important that you submit original assignments to get credit for your work.
- WE ARE HERE TO HELP. With all the uncertainty for the semester, the Instructors have decided to start the semester with synchronous zoom classes. This mode of delivery will be reevaluated based on student's feedback. The Instructors are doing their best to achieve the Course Learning Outcomes. If you have any questions or concerns related to this course, email the Instructor anytime or clarify the same during the class meeting hours or office hours.

### **UT Tyler Honor Code**

Every member of the UT Tyler community joins together to embrace: Honor and integrity that will not allow me to lie, cheat, or steal, nor to accept the actions of those who do.

### **Students Rights and Responsibilities**

To know and understand the policies that affect your rights and responsibilities as a student at UT Tyler, please follow this link: <http://www.uttyler.edu/wellness/rightsresponsibilities.php>

### **Campus Carry**

We respect the right and privacy of students 21 and over who are duly licensed to carry concealed weapons in this class. License holders are expected to behave responsibly and keep a handgun secure and concealed. More information is available at <http://www.uttyler.edu/about/campus-carry/index.php>

### **UT Tyler a Tobacco-Free University**

All forms of tobacco will not be permitted on the UT Tyler main campus, branch campuses, and any property owned by UT Tyler. This applies to all members of the University community, including students, faculty, staff, University affiliates, contractors, and visitors.

Forms of tobacco not permitted include cigarettes, cigars, pipes, water pipes (hookah), bidis, kreteks, electronic cigarettes, smokeless tobacco, snuff, chewing tobacco, and all other tobacco products.

There are several cessation programs available to students looking to quit smoking, including counseling, quitlines, and group support. For more information on cessation programs please visit [www.uttyler.edu/tobacco-free](http://www.uttyler.edu/tobacco-free).

### **Grade Replacement/Forgiveness and Census Date Policies**

Students repeating a course for grade forgiveness (grade replacement) must file a Grade Replacement Contract with the Enrollment Services Center (ADM 230) on or before the Census Date of the semester in which the course will be repeated. Grade Replacement Contracts are available in the Enrollment Services Center or at <http://www.uttyler.edu/registrar>. Each semester's Census Date can be found on the Contract itself, on the Academic Calendar, or in the information pamphlets published each semester by the Office of the Registrar.

Failure to file a Grade Replacement Contract will result in both the original and repeated grade being used to calculate your overall grade point average. Undergraduates are eligible to exercise grade replacement for only three course repeats during their career at UT Tyler; graduates are eligible for two grade replacements. Full policy details are printed on each Grade Replacement Contract.

The Census Date is the deadline for many forms and enrollment actions of which students need to be aware. These include:

- Submitting Grade Replacement Contracts, Transient Forms, requests to withhold directory information, approvals for taking courses as Audit, Pass/Fail or Credit/No Credit.
- Receiving 100% refunds for partial withdrawals. (There is no refund for these after the Census Date)
- Schedule adjustments (section changes, adding a new class, dropping without a "W" grade)
- Being reinstated or re-enrolled in classes after being dropped for non-payment
- Completing the process for tuition exemptions or waivers through Financial Aid

### **State-Mandated Course Drop Policy**

Texas law prohibits a student who began college for the first time in Fall 2007 or thereafter from dropping more than six courses during their entire undergraduate career. This includes courses dropped at another 2-year or 4-year Texas public college or university. For purposes of this rule, a dropped course is any course that is dropped after the census date (See Academic Calendar for the specific date).

Exceptions to the 6-drop rule may be found in the catalog. Petitions for exemptions must be submitted to the Enrollment Services Center and must be accompanied by documentation of the extenuating circumstance. Please contact the Enrollment Services Center if you have any questions.

### **Disability/Accessibility Services**

In accordance with Section 504 of the Rehabilitation Act, Americans with Disabilities Act (ADA) and the ADA Amendments Act (ADAAA) the University of Texas at Tyler offers accommodations to students with learning, physical and/or psychological disabilities. If you have a disability, including a non-visible diagnosis such as a learning disorder, chronic illness, TBI, PTSD, ADHD, or you have a history of modifications or accommodations in a previous educational environment, you are encouraged to visit <https://hood.accessiblelearning.com/UTTyler> and fill out the New Student application.

The Student Accessibility and Resources (SAR) office will contact you when your application has been submitted and an appointment with Cynthia Lowery, Assistant Director of Student Services/ADA Coordinator. For more information, including filling

out an application for services, please visit the SAR webpage at <http://www.uttyler.edu/disabilityservices>, the SAR office located in the University Center, # 3150 or call 903.566.7079.

### **Student Absence due to Religious Observance**

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor of such absences by the second class meeting of the semester.

#### **Student Absence for University-Sponsored Events and Activities**

If you intend to be absent for a university-sponsored event or activity, you (or the event sponsor) must notify the instructor at least two weeks prior to the date of the planned absence. At that time the instructor will set a date and time when make-up assignments will be completed.

### **Social Security and FERPA Statement**

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number. The electronic transmission of grades (e.g., via e-mail) risks violation of the Family Educational Rights and Privacy Act; grades will not be transmitted electronically.

### **Emergency Exits and Evacuation**

Everyone is required to exit the building when a fire alarm goes off. Follow your instructor's directions regarding the appropriate exit. If you require assistance during an evacuation, inform your instructor in the first week of class. Do not re-enter the building unless given permission by University Police, Fire department, or Fire Prevention Services.

### **Student Standards of Academic Conduct**

Disciplinary proceedings may be initiated against any student who engages in scholastic dishonesty, including, but not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts. "Cheating" includes, but is not limited to:

- copying from another student's test paper; using, during a test, materials not authorized by the person giving the test;
- failure to comply with instructions given by the person administering the test;
- possession during a test of materials which are not authorized by the person giving the test, such as class notes or specifically designed "crib notes". The presence of textbooks constitutes a violation if they have been specifically prohibited by the person administering the test;
- using, buying, stealing, transporting, or soliciting in whole or part the contents of an unadministered test, test key, homework solution, or computer program;
- collaborating with or seeking aid from another student during a test or other assignment without authority;
- discussing the contents of an examination with another student who will take the examination;
- divulging the contents of an examination, for the purpose of preserving questions for use by another, when the instructors has designated that the



examination is not to be removed from the examination room or not to be returned or to be kept by the student;

- substituting for another person, or permitting another person to substitute for oneself to take a course, a test, or any course-related assignment;
  - paying or offering money or other valuable thing to, or coercing another person to obtain an unadministered test, test key, homework solution, or computer program or information about an unadministered test, test key, home solution or computer program;
  - falsifying research data, laboratory reports, and/or other academic work offered for credit;
  - taking, keeping, misplacing, or damaging the property of The University of Texas at Tyler, or of another, if the student knows or reasonably should know that an unfair academic advantage would be gained by such conduct; and
  - misrepresenting facts, including providing false grades or resumes, for the purpose of obtaining an academic or financial benefit or injuring another student academically or financially.
- i. "Plagiarism" includes, but is not limited to, the appropriation, buying, receiving as a gift, or obtaining by any means another's work and the submission of it as one's own academic work offered for credit.
  - ii. "Collusion" includes, but is not limited to, the unauthorized collaboration with another person in preparing academic assignments offered for credit or collaboration with another person to commit a violation of any section of the rules on scholastic dishonesty.
  - iii. All written work that is submitted will be subject to review by plagiarism software.

#### **UT Tyler Resources for Students**

- [UT Tyler Writing Center](mailto:writingcenter@uttyler.edu) (903.565.5995), [writingcenter@uttyler.edu](mailto:writingcenter@uttyler.edu)
- [UT Tyler Tutoring Center](mailto:tutoring@uttyler.edu) (903.565.5964), [tutoring@uttyler.edu](mailto:tutoring@uttyler.edu)
- The Mathematics Learning Center, RBN 4021, this is the open access computer lab for math students, with tutors on duty to assist students who are enrolled in early-career courses.
- [UT Tyler Counseling Center](mailto:saroffice@uttyler.edu) (903.566.7254)

#### **Important Covid-19 Information for Classrooms and Laboratories**

Students are required to wear face masks covering their nose and mouth, and follow social distancing guidelines, at all times in public settings (including classrooms and laboratories), as specified by [Procedures for Fall 2020 Return to Normal Operations](#). The UT Tyler community of Patriots views adoption of these practices consistent with its [Honor Code](#) and a sign of good citizenship and respectful care of fellow classmates, faculty, and staff.

Students who are feeling ill or experiencing symptoms such as sneezing, coughing, or a higher than normal temperature will be excused from class and should stay at home and may join the class remotely. Students who have difficulty adhering to the Covid-19 safety policies for health reasons are also encouraged to join the class remotely. Students needing additional accommodations may contact the Office of Student Accessibility and Resources at University Center 3150, or call (903) 566-7079 or email [saroffice@uttyler.edu](mailto:saroffice@uttyler.edu).

**Recording of Class Sessions**

Class sessions may be recorded by the instructor for use by students enrolled in this course. Recordings that contain personally identifiable information or other information subject to FERPA shall not be shared with individuals not enrolled in this course unless appropriate consent is obtained from all relevant students. Class recordings are reserved only for the use of students enrolled in the course and only for educational purposes. Course recordings should not be shared outside of the course in any form without express permission.