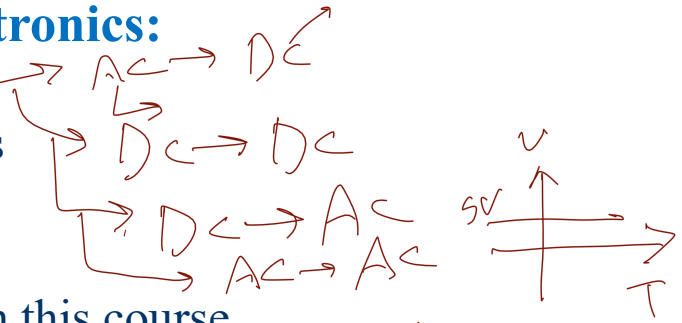
EE 4420
Power Electronics

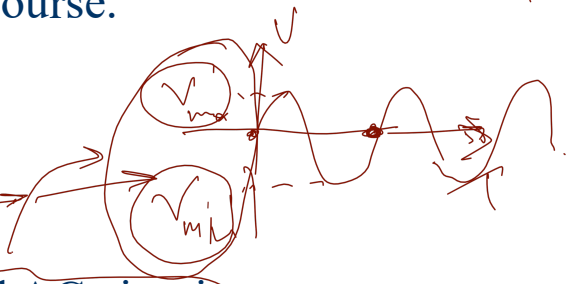
Dr. Abdullah Noman

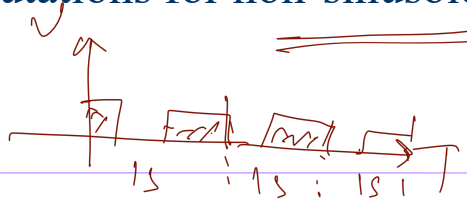
Course Description

This course will cover the following:

- **Introduction to Power Electronics:**
  - ✓ Converter Classification
  - ✓ Power Electronics Concepts
  - ✓ Electronic Switches
  - ✓ Switch Selection
  - ✓ Simulation Software used in this course.
- **Power Computations:**
  - ✓ Power and energy
  - ✓ Inductors and capacitors
  - ✓ Effective values: RMS
  - ✓ Power computations for sinusoidal AC circuits
  - ✓ Power computations for non-sinusoidal periodic waveforms







Course Description

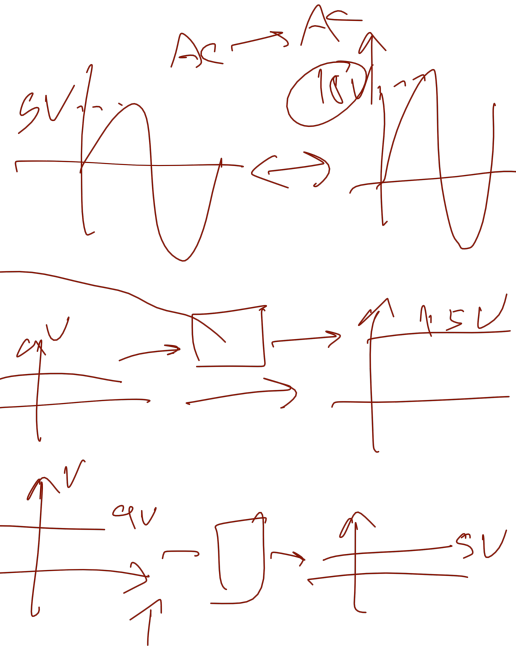
This course will cover the following:

- **Half-Wave Rectifiers:**
  - ✓ Resistive loads.
  - ✓ Resistive-Inductive loads.
  - ✓ RL-source load.
  - ✓ The Freewheeling Diode.
  - ✓ Half-Wave Rectifier With a Capacitor Filter.
  - ✓ The Controlled Half-Wave Rectifier.
- **Full-Wave Rectifiers:**
  - ✓ Single phase FW rectifiers.
  - ✓ Three-phase FW rectifiers

Course Description

This course will cover the following:

- **AC-AC Converter**
- **DC-DC Converters:**
  - ✓ Switching voltage regulators
  - ✓ Buck converter
  - ✓ boost converter
  - ✓ buck-boost converter
  - ✓ Cuk converter
- **DC power supplies**
- **DC to AC Inverters**



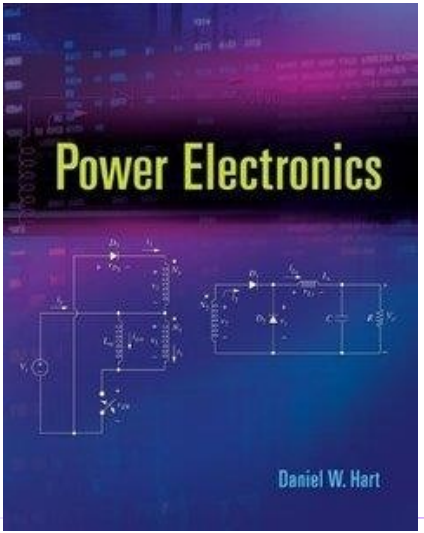
Course Resources

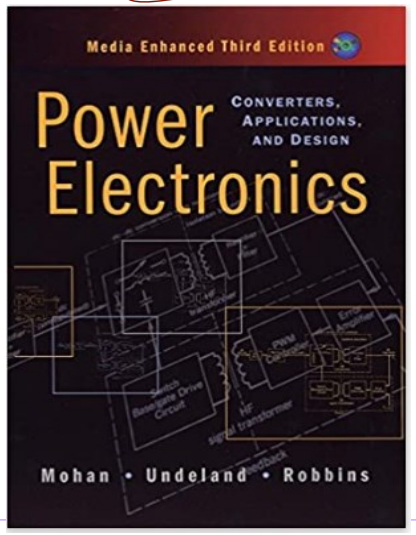
- **Course Resources**

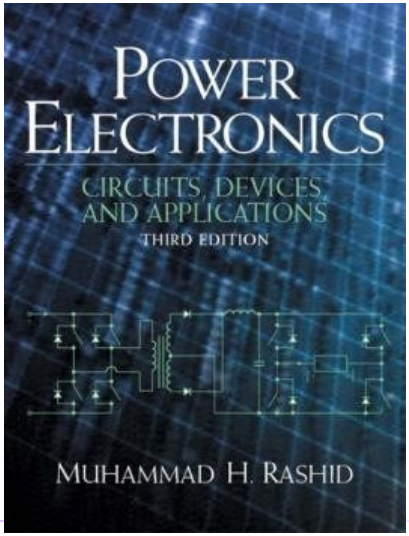
Textbook: Daniel W. Hart, "Power Electronics", McGraw Hill, 2011.

References:

- Mohan, “Power Electronics Converters, Applications, and Design”, Wiley, 3rd edition.
- Muhammed H. Rashid, " Power Electronics Circuits, Devices and Applications ", Prentice Hall, 2003.







Course Structure and Grading

- **Pre-requisites and Assumed Knowledge**

The pre-requisite for the course is EE 3171. It is further assumed that the students have good mathematical skills.

- **Lectures**
  - ➢2 hours of lectures per week.
  - ➢1 hour of tutorial per week.
  - ➢2 hour of Lab per week.
- **Grading**
  - ➢Lab
    - ✓ Reports (20%).
    - ✓ Project (5%).
  - ➢1 midterm exams (20 %)
  - ➢Final exams (40 %)
  - ➢Others (15%):
    - ✓ Project (5%)
    - ✓ H.Ws (5%)
    - ✓ Quizzes (5%)

➢ Mid-term exam
Date: 12th week,

Course Policy

General Rules:

- Course materials including lecture notes, presentations, assignments, etc. will be posted regularly on the University Learning Management System (LMS) portal at lms.psau.edu.sa
- **Use of mobile phones** or other electronic devices is **not allowed** during class
- Unless permitted by the instructor, all such electronic devices must be **switched off** or put on **silence** during class.
- Students are strongly encouraged to **ask questions** during lessons when prompted to do so by the instructor.
- If further clarification is needed, the students could **consult** the instructor during his assigned **office hours.**

Course Policy

Attendance:

- Punctual **attendance** of all classes is **crucial** for achieving the objectives and learning outcomes of this course.

  The correlation between attendance and performance is well established.
- Attendance is **compulsory** for all classes including lectures and tutorials.
- All students are required to **arrive at least 5 minutes** before the start of class.
- Attendance will be taken from week 1 and classes will start promptly **on time**.
- Attendance will be taken **immediately after 30 minutes from the starting time** of the lecture, and any student who arrives **after the attendance was taken** will be considered **absent**.

Course Policy

Attendance:

- According to PSAU policy, every student should **attend at least 75% of the course classes.**
- Any student whose overall attendance in a particular course is **below 75% will not be allowed** to sit the final exam for that course.
- If a student misses a class due to a medical reason, then he must provide a **medical certificate** from a public hospital within 10 days after his return to University. The certificate must be handed to the course instructor personally.
- Non-medical reasons for absence will not be accepted unless approved by the Students' Affairs.

Course Policy

Coursework:

- All coursework activities including assignments and quizzes will be announced in class and online together with deadlines for submission.
- All assignments should be **submitted on time**. Late submission will be penalized as follows: **20% off attained mark for every day late.**
- After **5 days** from the submission deadline, no assignment will be accepted and a **zero mark will be recorded** for the particular assignment.
- **Copying** others' work is **plagiarism** which is **illegal**. Plagiarised assignments will **not be marked** and instead a **zero mark will be given** to all involved.

Course Policy

Coursework:

- Marked coursework will be returned to students after **one week** from the submission deadline.
- Students are required to **check** their answers immediately **inform** the instructor of any **discrepancies** they may find in their marked coursework.

Course Policy

Makeup Strategy:

- There will be **no makeup** for missed quizzes or unsubmitted assignments.
- Missed quizzes or unsubmitted assignments will receive **zero marks**.
- Makeup for missed exams will be done according to the University Examination Policy.
- Any evidence for excused absence must be **submitted** to the instructor within **one week** from the date of the missed exam, and it must be approved by the Student's Affairs in the college.

Learning Outcomes of the course

After successful completion of this course, you should be able to:

1. Recognize the main applications of power electronics, power electronic devices (Diode, SCR, Transistor) and their characteristics, and the concept of switch selection.
2. Analyze the half wave controlled and uncontrolled AC/DC rectifier circuits.
3. Analyze the full wave controlled and uncontrolled AC/DC rectifier circuits.
4. Analyze and learn the design procedures of the different types of the DC/DC converters.
5. Analyze the AC voltage controller (AC/AC) circuits and describe their applications.
6. Analyze the square wave inverter, and the unipolar and bipolar PWM inverters.

Learning Outcomes of the course

After successful completion of this course, you should be able to:

7. Simulate basic electronic converter circuits using modern software.
8. Design and realize a mini-project power electronic converter that meet specified needs.
9. Conduct Lab experiments that include connection of different power electronic converters and collecting the needed measurements
10. Write technical reports that include description of the experiment, comments on the collected measurements and compare them with the theoretical results, and conclusions.

Studying PE: Guide

- Attend **ALL** lectures and tutorials.
- **WORK AT HOME AFTER EVERY CLASS**
- Read the slides from the Lecture.
- Read the respective chapters/sections and their examples in the textbooks.
- Solve all required problems (**do not miss homework**!).
- Write down all questions you have regarding a lecture/ tutorial/solved or unsolved problems, and visit the instructor **DURING THE OFFICE HOURS**