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OFFICE OF THE  
SENATE COUNCIL

## 1. General Information

1a. Submitted by the College of: ENGINEERING

Date Submitted: 9/14/2015

1b. Department/Division: Electrical and Computer Engineering

1c. Contact Person

Name: Aaron Cramer

Email: aaron.cramer@uky.edu

Phone: 7-9113

Responsible Faculty ID (if different from Contact)

Name:

Email:

Phone:

1d. Requested Effective Date: Semester following approval

1e. Should this course be a UK Core Course? No

## 2. Designation and Description of Proposed Course

2a. Will this course also be offered through Distance Learning?: No

2b. Prefix and Number: EE 503

2c. Full Title: Power Electronics

2d. Transcript Title:

2e. Cross-listing:

2f. Meeting Patterns

LECTURE: 3

2g. Grading System: Letter (A, B, C, etc.)

2h. Number of credit hours: 3

2i. Is this course repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester?

2j. Course Description for Bulletin: Study of solid-state power electronic devices and their applications. Examination of control philosophies, steady-state models, and numerical simulation of characterizing differential equations. Current topics of interest from the literature.

2k. Prerequisites, if any: EE 415G and EE 461 or consent of instructor

2l. Supplementary Teaching Component:

3. Will this course taught off campus? No

If YES, enter the off campus address:

4. Frequency of Course Offering: Spring,

Will the course be offered every year?: No

If No, explain: It would typically be offered every other year, but it could be offered every year.

5. Are facilities and personnel necessary for the proposed new course available?: Yes

If No, explain:

6. What enrollment (per section per semester) may reasonably be expected?: 20

7. Anticipated Student Demand

Will this course serve students primarily within the degree program?: Yes

Will it be of interest to a significant number of students outside the degree pgm?: No

If Yes, explain:

8. Check the category most applicable to this course: Traditional – Offered in Corresponding Departments at Universities Elsewhere,

If No, explain:

9. Course Relationship to Program(s).

a. Is this course part of a proposed new program?: No

If YES, name the proposed new program:

b. Will this course be a new requirement for ANY program?: No

If YES, list affected programs:

10. Information to be Placed on Syllabus.

a. Is the course 400G or 500?: Yes

b. The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable, from **10.a** above) are attached: Yes

## Distance Learning Form

Instructor Name:

Instructor Email:

Internet/Web-based: No

Interactive Video: No

Hybrid: No

1. How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations?

2. How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.

3. How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.

4. Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?

If yes, which percentage, and which program(s)?

5. How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?

6. How do course requirements ensure that students make appropriate use of learning resources?

7. Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

8. How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (<http://www.uky.edu/UKIT/>)?

9. Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? NO

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.

10. Does the syllabus contain all the required components? NO

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name:

SIGNATURE|HOLLOWAY|Lawrence E Holloway|EE 503 NEW Dept Review|20150910

SIGNATURE|HOLLOWAY|Lawrence E Holloway|EE 503 NEW Dept Review|20150930

SIGNATURE|BJSTOK0|Barbara J Brandenburg|EE 503 NEW College Review|20151209

SIGNATURE|JMETT2|Joanie Ett-Mims|EE 503 NEW Undergrad Council Review|20160413

SIGNATURE|ZNNIKO0|Roshan N Nikou|EE 503 NEW Graduate Council Review|20160512

## New Course Form

<https://myuk.uky.edu/sap/bc/soap/rfc?services=>

[Open in full window to print or save](#)

Generate R

## Attachments:

[Browse...](#)

Upload File

	ID	Attachment
Delete	6653	EE503Syllabus.docx
	First 1	Last

(\*denotes required fields)

## 1. General Information

- a. \* Submitted by the College of:  Submission Date:
- b. \* Department/Division:
- c.
- \* Contact Person Name:  Email:  Phone:
- \* Responsible Faculty ID (if different from Contact)  Email:  Phone:
- d. \* Requested Effective Date:  Semester following approval OR  Specific Term/Year<sup>1</sup>
- e.
- Should this course be a UK Core Course?  Yes  No
- If YES, check the areas that apply:
- Inquiry - Arts & Creativity  Composition & Communications - II
- Inquiry - Humanities  Quantitative Foundations
- Inquiry - Nat/Math/Phys Sci  Statistical Inferential Reasoning
- Inquiry - Social Sciences  U.S. Citizenship, Community, Diversity
- Composition & Communications - I  Global Dynamics

## 2. Designation and Description of Proposed Course.

- a. \* Will this course also be offered through Distance Learning?  Yes<sup>4</sup>  No
- b. \* Prefix and Number:
- c. \* Full Title:
- d. Transcript Title (if full title is more than 40 characters):
- e. To be Cross-Listed<sup>2</sup> with (Prefix and Number):
- f. \* Courses must be described by at least one of the meeting patterns below. Include number of actual contact hours<sup>3</sup> for each meeting pattern type.
- |  |  |                                 |                                 |
|--|--|---------------------------------|---------------------------------|
| <input type="text" value="3"/> Lecture | <input type="text"/> Laboratory <sup>1</sup>   | <input type="text"/> Recitation | <input type="text"/> Discussion |
| <input type="text"/> Indep. Study      | <input type="text"/> Clinical                  | <input type="text"/> Colloquium | <input type="text"/> Practicum  |
| <input type="text"/> Research          | <input type="text"/> Residency                 | <input type="text"/> Seminar    | <input type="text"/> Studio     |
| <input type="text"/> Other             | If Other, Please explain: <input type="text"/> |                                 |                                 |
- g. \* Identify a grading system:
- Letter (A, B, C, etc.)
- Pass/Fail
- Medicine Numeric Grade (Non-medical students will receive a letter grade)
- Graduate School Grade Scale
- h. \* Number of credits:
- i. \* Is this course repeatable for additional credit?  Yes  No
- If YES: Maximum number of credit hours:
- If YES: Will this course allow multiple registrations during the same semester?  Yes  No

## j. \* Course Description for Bulletin:

Study of solid-state power electronic devices and their applications. Examination of control philosophies, steady state models, and numerical simulation of characterizing differential equations. Current topics of interest from the literature.

## k. Prerequisites, if any:

EE 415G and EE 461 or consent of instructor

l. Supplementary teaching component, if any:  Community-Based Experience  Service Learning  Both3. \* Will this course be taught off campus?  Yes  No

If YES, enter the off campus address: \_\_\_\_\_

## 4. Frequency of Course Offering.

a. \* Course will be offered (check all that apply):  Fall  Spring  Summer  Winter

b. \* Will the course be offered every year?  Yes  No

If No, explain: It would typically be offered every other year, but it could be offered every year.

5. \* Are facilities and personnel necessary for the proposed new course available?  Yes  No

If No, explain: \_\_\_\_\_

## 6. \* What enrollment (per section per semester) may reasonably be expected? 20

## 7. Anticipated Student Demand.

a. \* Will this course serve students primarily within the degree program?  Yes  No

b. \* Will it be of interest to a significant number of students outside the degree pgm?  Yes  No

If YES, explain: \_\_\_\_\_

## 8. \* Check the category most applicable to this course:

Traditional – Offered in Corresponding Departments at Universities Elsewhere

Relatively New – Now Being Widely Established

Not Yet Found in Many (or Any) Other Universities

## 9. Course Relationship to Program(s).

a. \* Is this course part of a proposed new program?  Yes  No

If YES, name the proposed new program: \_\_\_\_\_

b. \* Will this course be a new requirement<sup>5</sup> for ANY program?  Yes  No

If YES<sup>5</sup>, list affected programs: \_\_\_\_\_

## 10. Information to be Placed on Syllabus.

a. \* Is the course 400G or 500?  Yes  No

If YES, the *differentiation for undergraduate and graduate students must be included* in the information required in 10.b. You must include: (i) identify additional assignments by the graduate students; and/or (ii) establishment of different grading criteria in the course for graduate students. (See SR

b.  \* The syllabus, including course description, student learning outcomes, and grading policies (and 400G-/500-level grading differentiation if applicable 10.a above) are attached.

<sup>1</sup> Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

<sup>2</sup> The chair of the cross-listing department must sign off on the Signature Routing Log.

⚠ In general, undergraduate courses are developed on the principle that one semester hour of credit represents one hour of classroom meeting per week for a semester, exclusive of any laboratory meeting. Laboratory meeting, generally, require two hours per week for a semester for one credit hour. (From SR 5.2.1)

⚠ You must also submit the Distance Learning Form in order for the proposed course to be considered for DL delivery.

⚠ In order to change a program, a program change form must also be submitted.

Rev 8/09

# EE 503-001: Power Electronics

Fall 2015

**Lecture:** MWF 12:00 pm–12:50 pm, F. Paul Anderson Tower 265

**Instructor:** Aaron M. Cramer

**Office:** F. Paul Anderson Tower 687B

**Office Hours:** TR 9:30 am–11:00 am or by appointment

**Phone:** 859-257-9113

**Email:** [aaron.cramer@uky.edu](mailto:aaron.cramer@uky.edu)

## Course Description

Study of solid-state power electronic devices and their applications. Examination of control philosophies, steady-state models, and numerical simulation of characterizing differential equations. Current topics of interest from the literature. Prereq: EE 415G and EE 461 or consent of instructor.

## Student Learning Outcomes

A student who has successfully completed this course should be able to:

1. Perform fundamental calculations associated with power electronic circuits.
2. Analyze dc-dc converters, including buck and boost converters.
3. Analyze rectifiers and inverters.
4. Use magnetic circuits to analyze magnetic devices in power electronic circuits.
5. Describe basic power electronic devices and their properties.
6. Understand objectives and approaches for control of power electronic circuits.

## Supplemental Materials

*Elements of Power Electronics*, 2nd ed., Philip T. Krein, Oxford University Press, 2015.

## Course Assignments

### *For undergraduate students*

7 projects weighted equally and valued at 100%

### *For graduate students*

7 projects weighted equally and valued at 80%

Final project valued at 20%

## Summary Description of Course Assignments

### *Projects*

Students will be assigned projects on Canvas (<https://uk.instructure.com/>) that will be due approximately every two weeks. All projects must be completed using MATLAB\Simulink without the use of additional toolboxes (e.g., SimPowerSystems) unless otherwise noted in the project description or previously approved by the instructor. Students are expected to prepare a report describing the objectives and background of the project, the mathematical models used in the project, the model implementation, the simulation studies, and analysis of the simulation studies. Students will submit their projects (report, all files necessary to run the simulation, and instructions to run the simulation) via email by the start of the class period in which they are due with the exception of Project 7, which will be due by the end of the final exam window as indicated below. For completing the mathematical modeling, model implementation, and simulation studies, undergraduate students may work in groups of two. Such collaboration must be mentioned in the report, and students are responsible for preparing their own objectives and background and analysis sections of the report. Late projects will only be accepted at the discretion of the instructor under extraordinary circumstances and with an appropriate penalty determined by the instructor. Each project is expected to take approximately 10 hours to complete, and the project reports are expected to be approximately 5–10 pages long. Report length is not an explicit factor used in grading; the projects will be graded based on the degree to which they satisfactorily address the required elements. In particular, projects will be graded according to the following rubric:

Objectives and Background	10%
Mathematical Modeling	25%
Model Implementation	30%
Simulation Studies	20%
Analysis	15%

### *Final Project (Graduate Students)*

Graduate students are expected to select a recent (last two years) journal article on power electronics and conduct a research-oriented modeling and simulation project based on this paper. Students are expected to prepare a report describing the objectives and background of the project, the mathematical models used in the project, the model implementation, the simulation studies, and analysis of the simulation studies. Students will submit their projects (report, all files necessary to run the simulation, and instructions to run the simulation) via email by the end of the final exam window as indicated below. Late projects will only be accepted at the discretion of the instructor under extraordinary circumstances and with an appropriate penalty determined by the instructor. The graduate student final project is expected to take approximately 20 hours to complete, and the project reports are expected to be approximately 10–20 pages long. Report length is not an explicit factor used in grading; the projects will be graded based on the degree to which they satisfactorily address the required elements. In particular, projects will be graded according to the rubric above.



## Course Grading

The minimum grade for each final score is given below. Graduate students may not receive a D; therefore, a grade below 70% will result in an E for the graduate student. These values may be adjusted downwards at the discretion of the instructor.

### *Grading Scale for Undergraduate Students*

90–100%=A  
80–89%=B  
70–79%=C  
60–69%=D  
Below 60%=E

### *Grading Scale for Graduate Students (No D for Graduate Students)*

90–100%=A  
80–89%=B  
70–79%=C  
Below 70%=E

## Tentative Course Schedule

The following schedule is tentative and may change at the discretion of the instructor. Deviations from this schedule will be announced.

Week	Monday	Wednesday	Friday
1	No class	Chapter 1	Chapter 1
2	Chapter 2	Chapter 2	Chapter 2
3	No class	Chapter 2	Chapter 2, Project 1
4	Chapter 2	Chapter 3	Chapter 3
5	Chapter 3	Chapter 3	Chapter 3, Project 2
6	Chapter 3	Chapter 4	Chapter 4
7	Chapter 4	Chapter 4	Chapter 4, Project 3
8	Chapter 4	Chapter 5	Chapter 5
9	Chapter 5	Chapter 5	Chapter 5, Project 4
10	Chapter 5	Chapter 8	Chapter 8
11	Chapter 8	Chapter 8	Chapter 8, Project 5
12	Chapter 8	Chapter 9	Chapter 9
13	Chapter 9	Chapter 9	Chapter 9, Project 6
14	Chapter 9	No class	No class
15	Chapter 11	Chapter 11	Chapter 11
16	Chapter 11	Chapter 11	Chapter 11

Project 7 and Final Project (Graduate Students): Monday, December 14, 2015 by 5:30 pm

## Final Exam Information

No final exam will be administered for this course. Project 7 and the final project (for graduate students) must be submitted as indicated above by Monday, December 14, 2015 at 5:30 pm.

## **Mid-Term Grade**

Mid-term grades will be posted in myUK (<http://myuk.uky.edu/>) by the deadline established in the Academic Calendar (<http://www.uky.edu/Registrar/AcademicCalendar.htm>)

## **Submission of Assignments**

Students will submit their projects (report, all files necessary to run the simulation, and instructions to run the simulation) via email (copied to the teaching assistant) by 12:00 pm on the project due date with the exception of Project 7, which will be due by the end of the final exam window indicated below. Groups should make one combined submission. Late projects will only be accepted at the discretion of the instructor under extraordinary circumstances.

## **Attendance Policy**

Attendance in the course is not mandatory. However, attendance is generally correlated with success in the course; your attendance is both expected and highly recommended. Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed per university policy. This attendance policy states the instructor's expectations and recommendations, but attendance is not a factor used in determining the student's grade in the course.

## **Excused Absences**

Students need to notify the professor of absences prior to class when possible. Senate Rules 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Two weeks prior to the absence is reasonable, but should not be given any later. Information regarding major religious holidays may be obtained through the Ombud (859-257-3737, [http://www.uky.edu/Ombud/ForStudents\\_ExcusedAbsences.php](http://www.uky.edu/Ombud/ForStudents_ExcusedAbsences.php)).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused) per University policy.

Per Senate Rule 5.2.4.2, students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required); and for making up the missed work. The professor must give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred.

## **Verification of Absences**

Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when

students claim an excused absence because of illness, or death in the family. Appropriate notification of absences due to University-related trips is required prior to the absence when feasible and in no case more than one week after the absence.

## **Academic Integrity**

Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to university policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: <http://www.uky.edu/Ombud>. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

Senate Rules 6.3.1 (see <http://www.uky.edu/Faculty/Senate/> for the current set of Senate Rules) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission.

When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording, or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code, or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work, which a student submits as his/her own, whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone.

When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content, and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas, which are so generally and freely circulated as to be a part of the public domain.

Please note: Any assignment you turn in may be submitted to an electronic database to check for plagiarism.

## **Accommodations Due to Disability**

If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. It is located on the corner of Rose Street and Huguelet Drive in the Multidisciplinary Science Building, Suite 407. You can reach them via phone at (859) 257-2754 and via email at [drc@uky.edu](mailto:drc@uky.edu). Their web address is <http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/>.