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| For Academic Affairs and Research Use Only | |
| Proposal Number |  |
| CIP Code: |  |
| Degree Code: |  |

**New or Modified Course Proposal Form**

**[] Undergraduate Curriculum Council**

**[X] Graduate Council**

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| **[X]New Course, [ ]Experimental Course (1-time offering), or [ ]Modified Course (Check one box)** |

Signed paper copies of proposals submitted for consideration are no longer required. Please type approver name and enter date of approval.

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| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date… **Department Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **COPE Chair (if applicable)** |
| Shubhalaxmi Kher 3/4/2022 **Department Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Head of Unit (if applicable)** |
| Brandon Kemp 3/4/2022  **College Curriculum Committee Chair** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Undergraduate Curriculum Council Chair** |
| Mary Elizabeth Spence 3/7/2022 **Office of Assessment (new courses only)** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **Graduate Curriculum Committee Chair** |
| Yeonsang Hwang 3/4/2022 **College Dean** | Alan Utter 3/31/2022  **Vice Chancellor for Academic Affairs** |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Enter date…  **General Education Committee Chair (if applicable)** |  |

1. **Contact Person (Name, Email Address, Phone Number)**

Mohammad Rasoul Narimani, [mnarimani@astate.edu](mailto:mnarimani@astate.edu), 8709723878

Brandon Kemp, [bkemp@astate.edu](mailto:bkemp@astate.edu), 8709722088

1. **Proposed starting term and Bulletin year for new course or modification to take effect**

Fall 2022, 2022-23

**Instructions:**

*Please complete all sections unless otherwise noted. For course modifications, sections with a “Modification requested?” prompt need not be completed if the answer is “No.”*

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|  | **Current (Course Modifications Only)** | **Proposed (New or Modified)**  *(Indicate “N/A” if no modification)* |
| **Prefix** |  | **EE** |
| **Number\*** |  | **~~5703~~ 5733\* Updated 4/19/22-SS** |
| **Title**  (include a short title that’s 30 characters or fewer) |  | **Power Electronics** |
| **Description\*\*** |  | **Analysis, design, modeling, and control of switching mode power converter circuits for ac-dc, dc-dc, dc-ac, and ac-ac conversion. Power semiconductor devices, passive components, and non-ideal sources and loads. Applications to industry, consumer goods, electric vehicles, and alternative energy.** |

***\**** Confirm with the Registrar’s Office that number chosen has not been used before and is available for use. For variable credit courses, indicate variable range. *Proposed number for experimental course is 9*.

\*\*Forty words or fewer (excepting prerequisites and other restrictions) as it should appear in the Bulletin.

1. **Proposed prerequisites and major restrictions** **[Modification requested? Yes/No]**

(Indicate all prerequisites. If this course is restricted to a specific major, which major. If a student does not have the prerequisites or does not have the appropriate major, the student will not be allowed to register).

1. **Yes / No** Are there any prerequisites? YES
   1. If yes, which ones?

EE 3403

* 1. Why or why not?

Power electronic requires basic knowledge about diode and family of transistors. The power transistors are the main element of power electronics which deals with the power transfer characteristics. Student learn about diode and transistor in EE 3403 (Electronics I).

1. **Yes / No** Is this course restricted to a specific major? No
   1. If yes, which major? Enter text...
2. **Proposed course frequency [Modification requested? Yes/No]**

(e.g. Fall, Spring, Summer; if irregularly offered, please indicate, “irregular.”) *Not applicable to Graduate courses.*

1. **Proposed course type [Modification requested? Yes/No] No**

Will this course be lecture only, lab only, lecture and lab, activity (e.g., physical education), dissertation/thesis, capstone, independent study, internship/practicum, seminar, special topics, or studio? Please choose one.

Lecture only

1. **Proposed grade type [Modification requested? Yes/No] No**

What is the grade type (i.e. standard letter, credit/no credit, pass/fail, no grade, developmental, or other [please elaborate])

Standard letter

1. **Yes / No** Is this course dual-listed (undergraduate/graduate)? YES
2. **Yes / No** Is this course cross-listed? No

*(If it is, all course entries must be identical including course descriptions. Submit appropriate documentation for requested changes. It is important to check the course description of an existing course when adding a new cross-listed course.)*

**a.** – If yes, please list the prefix and course number of the cross-listed course.

Enter text...

**b.** – **Yes / No** Can the cross-listed course be used to satisfy the prerequisite or degree requirements this course satisfies?

Enter text...

1. **Yes / No** Is this course in support of a new program? No

a. If yes, what program?

1. **Yes / No** Will this course be a one-to-one equivalent to a deleted course or previous version of this course (please check with the Registrar if unsure)? No

a. If yes, which course?

Enter text...

**Course Details**

1. **Proposed outline** **[Modification requested? Yes/No] No**

(The course outline should be topical by weeks and should be sufficient in detail to allow for judgment of the content of the course.)

Week 1 **Introduction; Power Calculations; Power Semiconductors**

Week 2 **Power Semiconductors, Half-Wave Rectifiers; Half-Wave Rectifiers**

Week 3 **Half-Wave Rectifiers; Full-Wave Rectifier with R-L Load**

Week 4 **Full-Wave Rectifiers with R-C Load; Controlled Full-Wave Rectifiers + Three-Phase Rectifiers**

Week 5 **AC Voltage Controllers + Buck Converter (CCM);**

Week 6 **Buck Converter (CCM)**

Week 7 **Boost Converter + Buck-Boost Converter; Buck-Boost Converter + DCM**

Week 8 **Discontinuous Conduction Mode; Flyback Converter + Forward Converter**

Week 9 **Forward Converter; Push-Pull Converter + Full Bridge Converter**

Week 10 **Half-Bridge Converter + Closed-Loop Control + Converter Modeling; Inverters**

Week 11 **Inverters; PWM Inverters**

Week 12 **PWM Inverters + Three-Phase Inverters; Three-Phase PWM Inverters**

Week 13 **Soft Switching; ZCS Buck Converter**

Week 14 **ZVS Buck Converter; Load Resonant Converters**

Week 15 **Soft Switching**

1. **Proposed special features** **[Modification requested? Yes/No]** No

(e.g. labs, exhibits, site visitations, etc.)

Exhibits/demonstrations

1. **Department staffing and classroom/lab resources**

**classroom**

1. Will this require additional faculty, supplies, etc.?

No

1. **Yes / No** Does this course require course fees?

*If yes: please attach the New Program Tuition and Fees form, which is available from the UCC website.*

**Justification**

**Modification Justification (Course Modifications Only)**

1. Justification for Modification(s)

Enter text...

**New Course Justification (New Courses Only)**

1. Justification for course. Must include:

a. Academic rationale and goals for the course (skills or level of knowledge students can be expected to attain)

Power electronics is a key enabling technology in essentially all electronic systems and is increasingly important in the grid interface of renewable energy sources and in efficient electrical loads. It will greatly enhance the role and value of electricity in all aspects from generation to the end of use. Power electronics represents an enabling means in enhancing the role and value of electricity. The necessity for power electronics technology in these rapidly expanding areas creates an increasing need for design engineers equipped with knowledge and skills to actively participate in multidisciplinary teams. Power Electronics course familiarizes student with various topics including diode and family of transistor. This course teaches students to analyze, design, model, and control switching mode power converter circuits for ac-dc, dc-dc, dc-ac, and ac-ac conversion. By learning how rectifiers, dc-to-dc converters, and inverters are designed, students will learn the fundamentals for designing their own power electronics devices, such as battery chargers, switched-mode power supplies, solar inverters, and variable frequency drives, among others. Having knowledge about these topics enable students to better understand and model various industrial converters and rectifiers which are the essential equipment for the booming renewable energy industry. Throughout the course, practical numerical problems are solved to aid students’ understanding of power electronics.

b. How does the course fit with the mission of the department? If course is mandated by an accrediting or certifying agency, include the directive.

Graduates of the Master of Science in Engineering student outcomes should have an ability to apply advanced mathematical concepts to model physical systems and engineering processes to drive knowledge based design and knowledge of advanced cross-disciplinary engineering sciences, and an ability to relate physical concepts from multiple engineering disciplines.

c. Student population served.

Master of Science in Engineering (MSE) students

d. Rationale for the level of the course (lower, upper, or graduate).

This is an advanced course requiring an upper level prerequisite: EE 3403

**Assessment**

**Assessment Plan Modifications (Course Modifications Only)**

1. **Yes / No** Do the proposed modifications result in a change to the assessment plan?

*If yes, please complete the Assessment section of the proposal*

**Relationship with Current Program-Level Assessment Process (Course modifications skip this section unless the answer to #18 is “Yes”)**

1. What is/are the intended program-level learning outcome/s for students enrolled in this course? Where will this course fit into an already existing program assessment process?

This course is an elective course in the Master of Science in Engineering (MSE) degree plan and won’t be used for direct assessment. This course contributes to two outcomes:

PLO 2: an ability to apply advanced mathematical concepts to model physical systems and engineering processes to drive knowledge based design.

PLO 3: knowledge of advanced cross-disciplinary engineering sciences, and an ability to relate physical concepts from multiple engineering disciplines.

1. Considering the indicated program-level learning outcome/s (from question #19), please fill out the following table to show how and where this course fits into the program’s continuous improvement assessment process.

*For further assistance, please see the ‘Expanded Instructions’ document available on the UCC - Forms website for guidance, or contact the Office of Assessment at 870-972-2989.*

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| **Program-Level Outcome 2 (from question #19)** | An ability to apply advanced mathematical concepts to model physical systems and engineering processes to drive knowledge based design; |
| Assessment Measure | Direct Assessment: ENGR 6023 Advanced Engineering Math assignment  Indirect Assessment Tool: Graduate survey |
| Assessment  Timetable | Assess every 2 years according to the College of Engineering and Computer Science assessment schedule. |
| Who is responsible for assessing and reporting on the results? | MSE Graduate Program Director |

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| **Program-Level Outcome 3 (from question #19)** | Knowledge of advanced cross-disciplinary engineering sciences, and an ability to relate physical concepts from multiple engineering disciplines. |
| Assessment Measure | Direct Learning Activity: Students will endure an oral thesis examination which includes topics relating research to the broader impacts of engineering, technology, and society. ENGR 690 V Thesis  Direct Assessment: Student performance will be assessed by the thesis examination committee using a rubric.  Indirect Assessment Tool: Graduate survey" |
| Assessment  Timetable | Assess every 2 years according to the College of Engineering and Computer Science assessment schedule. |
| Who is responsible for assessing and reporting on the results? | MSE Graduate Program Director |

*(Repeat if this new course will support additional program-level outcomes)*

**Course-Level Outcomes**

1. What are the course-level outcomes for students enrolled in this course and the associated assessment measures?

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| **Outcome 1** | Student will learn the basic concepts of operation of dc-dc converters in steady state in continuous and discontinuous modes and be able to analyze basic converter topologies. |
| Which learning activities are responsible for this outcome? | In-class discussion and illustrations  Demonstration of analysis results in presentations  Evaluate simulations and projects |
| Assessment Measure | Exams, quiz, and project . |

*(Repeat if needed for additional outcomes)*

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| **Outcome 2** | Student will know the role of Power Electronics in utility-related applications which are becoming extremely important. |
| Which learning activities are responsible for this outcome? | In-class discussion and illustrations  Demonstration of analysis results in presentations  Evaluate simulations and projects |
| Assessment Measure | Exams, quiz, and project . |

**Bulletin Changes**

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| **Instructions** |
| **Please visit** [**http://www.astate.edu/a/registrar/students/bulletins/index.dot**](http://www.astate.edu/a/registrar/students/bulletins/index.dot) **and select the most recent version of the bulletin. Copy and paste all bulletin pages this proposal affects below. Please include a before (with changed areas highlighted) and after of all affected sections.**  **\*Please note: Courses are often listed in multiple sections of the bulletin. To ensure that all affected sections have been located, please search the bulletin (ctrl+F) for the appropriate courses before submission of this form.** |

**Page 503, before the heading “Engineering Management (EGRM)”**

**Before**

**EE 5383. Digital Electronics II** Continuation of the study of digital circuit design with emphasis on the design of larger systems and use of LSI components. Register transfer logic, computer interfacing and design, microcomputer based system design. Prerequisite, C or better in EE 3333. Dual listed as EE 4383.

**EE 5743. Digital Communications** Continuation of communications theory with emphasis on modulation and demodulation techniques, signal space representation of digitally modulated signals, coherent/non-coherent detection methods (and receiver structures) in AWGN channel, error performance, communication over band-limited channels with ISI and AWGN. Prerequisite, EE 3373 and EE 4333. Dual-listed as EE 4743.

**After**

**EE 5383. Digital Electronics II** Continuation of the study of digital circuit design with emphasis on the design of larger systems and use of LSI components. Register transfer logic, computer interfacing and design, microcomputer based system design. Prerequisite, C or better in EE 3333. Dual listed as EE 4383.

**EE 5703. Power Electronics**   Analysis, design, modeling, and control of switching mode power converter circuits for ac-dc, dc-dc, dc-ac, and ac-ac conversion. Power semiconductor devices, passive components, and non-ideal sources and loads. Applications to industry, consumer goods, electric vehicles, and alternative energy. Prerequisite, undergraduate introduction to electronics. Dual listed as EE 5703.

**EE 5743. Digital Communications** Continuation of communications theory with emphasis on modulation and demodulation techniques, signal space representation of digitally modulated signals, coherent/non-coherent detection methods (and receiver structures) in AWGN channel, error performance, communication over band-limited channels with ISI and AWGN. Prerequisite, EE 3373 and EE 4333. Dual-listed as EE 4743.