Curriculum Course Request New Course ECE 5525 - A-2018-ECE-115; effective term: 202040

Bradley J Bazuin
Mon 12/3/2018 1:09 PM

To: Raja G Aravamathan <raja.aravamathan@wmich.edu>; Said M Abubakr <said.abubakr@wmich.edu>
Cc: Holly Blanks <holly.blanks@wmich.edu>

1 attachments (255 KB)
5525 Syl-F18.pdf

Please verify your data for New Curriculum Course Request for department: ECE; college: A.
Go to the following URL to complete your worklist items: https://bwfp1.cc.wmich.edu:7102/wfbprod

Date of request: 21-NOV-2018
Request ID: A-2018-ECE-115

College: A
Department: ECE

Initiator name: Janos Grantner
Initiator email: janos.grantner@wmich.edu

Proposed effective term: 202040

Does course need General Education approval?: N

Will course be used in teacher education?: N

If 5000 level course, prerequisites apply to: B

Proposed course data:
New Course ECE 5525
New course selected: This new course is not seeking approval as a general education course.

1. Proposed course prefix and number:
ECE 5525

2. Proposed credit hours:
3

3. Proposed course title:
Digital Design
4. Proposed course prerequisites:
none

5. Proposed course corequisites:
none

6. Proposed course prerequisites that may be taken concurrently (before or at the same time):
none

7. Minimum grade for prerequisites (default grades are D for Undergrad and C for Grad):
none

8. Major and/or minor restrictions:
Not Applicable

9. List all the four-digit major and/or minor codes (from Banner) that are to be included or excluded:
none

10. Classification restrictions:
Not Applicable

11. List all the classifications (freshman, sophomore, junior, senior) that are to be included or excluded:
none

12. Level restriction:
Not Applicable

13. List the level (undergraduate, graduate) that is to be included or excluded.
Not Applicable

14. Do prerequisites and corequisites for 5000-level courses apply to undergraduates, graduates, or both?
UG

15. Is this a multi-topic course?
No

16. Proposed course title to be entered in Banner:
Digital Design

17. Is this course repeatable for credit?
No

18. Is this course mandatory credit/no credit?
No

19. Select class type:
Lecture/Lab/Discussion

20. How many contact hours per week for this course?
3-3

A. Please choose Yes or No to indicate if this class is a Teacher Education class:
https://outlook.office.com/owa/?realm=WMICH.EDU&esvurl=1&ll-cc=1033&modurl=0&path=/mail/search
B. Please choose the applicable class level:
Both

C. Please respond Yes if this is a current general education course and/or a course being submitted for the new WMU Essential Studies program. Please respond No if it is neither.
No

D. Explain briefly and clearly the proposed improvement.
The course proposal and companion program change requests are all part of a multiyear plan to better support MS computer engineering students, particularly in our ability to insure incoming international students learn or have learned digital design fundamentals and provide the course in a timely manner (fall semester).

The course has been offered as a special topics course, ECE 5950 Digital Design. The ECE 5525 course number would be a regular catalog course number.

E. Rationale. Give your reason(s) for the proposed improvement. (If your proposal includes prerequisites, justify those, too.).
Previously, if students were conditionally admitted or needed further training in one of the technological pillars of the discipline, digital design, they either had to take ECE 3550 in the fall or wait for a somewhat related course only offered in Summer I (ASIC design). This had significant negative consequences in terms of undergraduate course costs or in terms of a time delay (two full semesters) to be allowed or enabled to take more advanced courses.

In Fall 2017 and effective Fall 2018, we changed ECE 3550 to ECE 4525. As the undergraduate digital design course has evolved with the available technology, lab-based components and software language and simulation-based design methodology, the challenge and complexity warranted the change and as a 4000-level course it could be cross-listed with a 5000-level course for graduate credit (and the accelerated MS - i.e., AGDP). As further benefits, first, the course is naturally a fall-only class so that incoming graduate students could immediately take it and make progress, and second, with limited faculty and funding, no additional faculty lines or positions or even funding would be required (except for possibly an additional lab TA).

Overall, we are very hopeful, that this will be a significant benefit to incoming MS computer engineering and even PhD students. It may also reduce the stigma and cost for conditionally admitted students in not requiring them to take an extra undergraduate course. Since this may also be a factor in whether a conditionally admitted students comes to WMU, it may even improve MS Computer Engineering enrollment.

F. List the student learning outcomes for the proposed course or the revised or proposed major, minor, or concentration. These are the outcomes that the department will use for future assessments of the course or program.
Faculty assessment of student learning, progress, and retention has suggested that an earlier program course offering that focuses on an educational pillar of computer engineering, digital design, would be beneficial. Students will be working on design synthesis-oriented homework assignments, labs and three projects. Out of the three graduate learning outcomes that have been established for graduate courses in the ECE department the capability to communicate work results effectively is chosen. It will be assessed by taking into consideration of the quality of one of the project reports and the oral presentation skills of the team members during the demonstration of the project.

G. Describe how this curriculum change is a response to student learning assessment outcomes that are part of a departmental or college assessment plan or informal assessment activities.
Graduate advising has identified digital design as a challenge and concern for incoming (particularly international) graduate students. As a digital design is fundamental to the computer engineering discipline, a fall course that counts toward the graduate degree can help student retention and may help increase enrollment. It will also reduce the number of undergraduate credits mandated for students conditionally enrolled.

H. Effect on other colleges, departments or programs. If consultation with others is required, attach evidence of consultation
and support. If objections have been raised, document the resolution. Demonstrate that the program you propose is not a duplication of an existing one.

No effect.

I. Effect on your department’s programs. Show how the proposed change fits with other departmental offerings. Due to this change, along with the cross-listed ECE 4525 class, a number of positive effects are expected with respect to the Bachelor’s and Master’s programs in Computer Engineering, and also in the ECE PhD program.

By taking advantage of the cross-listed ECE 5525 course, outstanding Bachelor’s students can take that option with the instructor’s permission. For students in the Accelerated Bachelor’s/Master’s programs (AGDP) the cross-listed ECE 5525 course will allow them to enroll in a class that will count towards both their undergraduate and graduate degrees.

Both for unconditionally and conditionally admitted Master’s students in Computer Engineering, the ECE 5525 course will provide for excellent preparation, as a prerequisite, towards 6000-level courses in Computer and Electrical Engineering, right from their first (fall) semester.

Those ECE PhD students who want to take the Digital Design subject as part of their Qualifying Exams enrolling in the ECE 5525 course will significantly increase their chances for passing the test. By taking the course they will also earn credits towards their graduation.

Those Master’s students in Computer Science, and other engineering programs who would like to pursue a minor in Computer Engineering will have the opportunity to take the ECE 5525 course for credit.

J. Effects on enrolled students: are program conflicts avoided? Will your proposal make it easier or harder for students to meet graduation requirements? Can students complete the program in a reasonable time? Show that you have considered scheduling needs and demands on students’ time. If a required course will be offered during summer only, provide a rationale.

Both for unconditionally and conditionally admitted Master’s students in Computer Engineering, the ECE 5525 course will provide for excellent preparation, as a prerequisite, towards 6000-level courses in Computer and Electrical Engineering, right from their first (fall) semester.

Those ECE PhD students who want to take the Digital Design subject as part of their Qualifying Exams enrolling in the ECE 5525 course will significantly increase their chances for passing the test. By taking the course they will also earn credits towards their graduation.

K. Student or external market demand. What is your anticipated student audience? What evidence of student or market demand or need exists? What is the estimated enrollment? What other factors make your proposal beneficial to students? The current ECE 5950 class enrollment is four Computer Engineering Master’s student. With the proposed regular course number along with its listing as a foundation course in the Graduate Catalog it is expected that the enrollment will gradually grow (to include nearly all MS computer engineering students) since the course covers important contemporary topics in the digital systems design area.

Design of embedded systems using Field Programmable Gate Arrays (FPGAs) and System-on-Chip (SoC) devices along with the necessary Computer Aided Design (CAD) tools has been a dynamically expanding area in industry. The proposed ECE 5525 course will expose students to this approach of designing digital systems. They will acquire highly marketable skills which will help them in securing employment.

L. Effects on resources. Explain how your proposal would affect department and University resources, including faculty, equipment, space, technology, and library holdings. Tell how you will staff additions to the program. If more advising will be needed, how will you provide for it? How often will course(s) be offered? What will be the initial one-time costs and the
ongoing base-funding costs for the proposed program? (Attach additional pages, as necessary.)
There is no effect on faculty resources, if an additional lab section is required at most one additional lab section (supporting up to 20 students) for graduate students adding a 1/3 TA position may be required.

If the combined undergraduate/graduate class enrollment exceeds 20 students then a new lab section should be scheduled in the B-210 laboratory. The B-210 laboratory has sufficient resources to handle the increased class enrollment.

M. With the change from General Education to WMU Essential Studies, this question is no longer used.

For courses requesting approval as a WMU Essential Studies course, a syllabus identifying the student learning outcomes and an action plan for assessing the student learning outcomes must be attached in the Banner Workflow system.

Not Applicable

N. (Undergraduate proposals only) Describe, in detail, how this curriculum change affects transfer articulation for Michigan community colleges. For course changes, include detail on necessary changes to transfer articulation from Michigan community college courses. For new majors or minors, describe transfer guidelines to be developed with Michigan community colleges. For revisions to majors or minors, describe necessary revisions to Michigan community college guidelines. Department chairs should seek assistance from college advising directors or from the admissions office in completing this section.

N/A

O. Current catalog copy:
none

P. Proposed catalog copy:
Analysis of the real-time behavior of combinational and sequential circuits. Analysis and synthesis of synchronous and asynchronous sequential logic circuits. VHDL-based design, simulation and prototyping of digital logic circuits and systems using Field Programmable Gate Arrays (FPGAs) and contemporary Computer-Aided Design (CAD) tools.

Department Curriculum Chair approver: Raghvendra Gejji

Department Curriculum Chair comment:

Date: 30-NOV-2018

Department approver: Bradley Bazuin

Chair comment:

Date: 03-DEC-2018
ECE 5525 DIGITAL DESIGN
FALL 2019

Instructor:    Dr. Janos Grantner
Office:       Room A-246, Floyd Hall
Phone:        (269) 276-3154
Email:        janos.grantner@wmich.edu
Web Home Page: http://homepages.wmich.edu/~grantner/ece4525
Class:        MWF 11:30am – 12:20pm, D-210, Floyd Hall
Lab:          W 6:30 - 9:00pm, B-210, Floyd Hall (Lab TA: Mr. Martin Cowley)
Office Hours: MW: 5:00 - 6:00pm, or by appointment

Texts:
Recommended: Instructor's Lecture Notes that are made available through the Class Web Page.

Software (required): Current Xilinx Vivado WebPack Edition and ModelSim PE Student Edition by Mentor Graphics. These programs can be downloaded from the respective Web sites at no charge.

Parts Kits (required): details are given on the Class Web Page

Prerequisite:    ECE 2500, or graduate standing

Course Description
The objective of this class is to develop systematic techniques for large-scale digital logic design and analysis. We will primarily be concerned with the design of multi-input, multi-output system controllers, which provide the central control signals that orchestrate the collection of hardware devices found in a digital system. This being the case, much of the work in this course will center upon the synchronous state machine design of system controllers using Field Programmable Gate Arrays (FPGAs). In addition, the design of asynchronous sequential machines and the transient behavior of logic circuits will be examined. The labs and the two design projects will be based upon the Nexys 4 DDR FPGA Development Board (Xilinx Artix-7 FPGA).
Lab assignments will be carried out using the students’ own FPGA Development Boards. Students will be designing, simulating and implementing their circuits using VHDL and professional CAD tools by Xilinx and Mentor Graphics. Licensed Xilinx and Mentor Graphics tools are available on
PC workstations located in the Microcomputer Lab (Room B-210). The subject matter is considered in the required text, in the Instructor's Lecture Notes, and in the other recommended texts. Additional materials will be posted on the Class Home Page, as needed. The Data Sheets of those integrated circuits that will be referred to in homework assignments and in the design projects can be found in the respective manufacturers' Web sites.

Course Procedure

All course work (homework assignments, prelab assignments, lab reports and project reports should be submitted through the appropriate Drop Boxes in Elearning (.pdf files).

Lab Work
The platform in the lab is the Nexys 4 DDR Board (Xilinx Artix-7 FPGA chip). Students are required to work with their own Nexys 4 DDR boards and Parts Kits in the lab. Outside of the scheduled and extended lab hours students should use their own copies of the current, free Xilinx Vivado Webpack Edition and the ModelSim PE Student Edition by Mentor Graphics, respectively, to work on the course assignments.

For the laboratory you will also need a thumb drive, a large solderless breadboard and the Parts Kits as published on the Class Web Page. You will work in the lab in teams. A team is usually made up of two students, however, each student is required have a Nexys 4 DDR Board, the free software referred to above, a large solderless breadboard, and a Parts Kit. That will facilitate work being done simultaneously on lab and homework assignments and the design projects.

We will be using standard scientific/engineering procedure regarding laboratory reports. This means that you are expected to come to class prepared. Prelab Assignments will be posted on the Class Web Page. The objective and design sections (the latter contains VHDL code, circuit schematic diagrams, timing diagrams, math formulas, etc.) of your lab report should be completed before lab as a draft. The finalized design, data/results and conclusion sections of the Team’s Lab Report should be completed either during the lab session, or shortly thereafter. In the conclusion section you will describe major concepts observed/discovered, discuss any anomalies and suggest what caused them.

Prelab Reports should be submitted through the appropriate Drop Boxes to the Lab TA. They will be evaluated and checked by the Lab TA at the beginning of each lab. Missing, or insufficient Prelab Reports will be penalized by losing 3 pts (out of 12 pts) for the lab.

Some sections of the Lab reports may be done in pencil but, in general, typed reports using a word processor are required. The penalty will be severe for illegible writing, sloppy schematics and drawings. Lab Reports are due no later than 9:00pm, on Monday, following the lab. Late Lab Reports will be penalized by -10% for each day they are tardy, or will be assigned 0pts after three days unless prior arrangements have been made. Lab Reports should be submitted through the appropriate Drop Boxes to the Lab TA. If you don't show up for a lab, you forfeit the points associated with it and cannot later make up the lab. Exceptions will be made only for those individuals who contact their Lab TA before the lab, giving an adequate reason why they cannot attend that day.
Note: you must achieve a passing grade in the lab (total 60% out of 100%) to pass the class.

Plagiarism and/or the copying/duplication of another student's, or team's designs or written reports will result in zero scores for the lab, or homework, or design project for all individuals involved.

There will be a Lab Final (worth of three regular labs).

Open Lab
Students will be given swipe card access to the B-210 Lab. There will be some supervised Extended Lab Hours with the Lab TA, or the Homework Grader being present. The schedule will be posted on the Class Home Page. Outside of the B-210 Lab hours students are expected to work on their homework, lab and project assignments using their own computers, installed CAD programs, as well as their own boards and parts.

Exams, Projects and Homework Assignments
There will be two exams to be taken, as well as three design projects to complete, and homework to be done. Homework is an individual assignment! The Mid-Term and Final Exams will consist of short analytical or design problems and be held in class. The Projects will cover design problems formulated from a set of design specifications and will be done outside of class. Projects will be carried on in teams of typically two students. Students may also elect to work on their projects alone. The project assignments should be designed using the CAD tools introduced in the course and should be built on the students' own solderless breadboards as functioning circuits. The list of the required electronic components is published on the Class Web Page. The demonstration of the project circuits working correctly will be worth up to 40% of the credit assigned. Early demonstrations are encouraged. Dates and times for the demos (in Room B-210) will be posted on the Class Home Page.

Projects and homework have strict due dates. Late homework assignments will not be accepted. Projects will be accepted up to three business days after due date (but not after the last day of classes, though) but will be penalized by -10% credit for each day that is tardy! Failure to attend an exam or work on a project will result in a grade X for the class. Make-up exams will only be given under extreme circumstances, and in any case, students should ask the course instructor prior to any scheduled evaluation.

Since the course is to be cross-listed with ECE 4525 the following grading policies outline the respective requirements.

Grading Policy
Grades will be determined on the basis of performance on exams, projects, and homework, according to the following weights:

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<th>ECE 4525 Section</th>
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<tr>
<td>Homework:</td>
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<tr>
<td>Lab Work:</td>
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<td>Final Exam:</td>
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A: 87 - 100%  
BA: 82 - 86%  
B: 72 - 81%  
CB: 67 - 71%  
C: 57 - 66%  
D: 47 - 56%  
E: <47%

A: 90 - 100%  
BA: 85 - 89%  
B: 75 - 84%  
CB: 70 - 74%  
C: 60 - 69%  
D: 50 - 59%  
E: <50%

In borderline cases, the Final Exam may be given a higher weight, up to the instructor's discretion.

**ECE 5525 Project Due Dates**
- Project #1 due: 3:30pm, Tuesday, October 22, 2019
- Project #2 due: 3:30pm, Tuesday, November 12, 2019
- Project #3 due: 3:30pm, Tuesday, December 3, 2019
- Demonstrations will be given in B-210, Floyd Hall

Exam Dates
- Midterm Exam: 11:30am - 12:20pm, Friday, October 11, 2019, D-210
- Lab Final Exam: 6:30 - 9:00pm, Wednesday, December 4, 2019, B-210
- Final Exam: 10:15am - 12:15pm, Monday, December 9, 2019, D-210

**Codes, Policies, Processes and Procedures**

The ECE 5525 Web Home Page will be used as official communications media for the class.

The WMU College of Engineering and Applied Sciences Honesty Code will apply in this course.

Homework is individual work! Students may discuss with their classmates the basic approaches to arrive at the solutions in principle. However, they are not allowed to share calculations, program files, and the like. Similarly, there should not be leaks of concrete design information among lab and project teams, respectively.

Students are responsible for making themselves aware of and understanding the University policies and procedures that pertain to Academic Honesty. These policies include cheating, fabrication, falsification and forgery, multiple submission, plagiarism, complicity and computer misuse. The academic policies addressing Student Rights and Responsibilities can be found in the Graduate Catalog at [http://catalog.wmich.edu/content.php?catoid=25&navoid=1030](http://catalog.wmich.edu/content.php?catoid=25&navoid=1030). If there is reason to believe you have been involved in academic dishonesty, you will be referred to the Office of Student Conduct. You will be given the opportunity to review the charge(s) and if you
believe you are not responsible, you will have the opportunity for a hearing. You should consult with your instructor if you are uncertain about an issue of academic honesty prior to the submission of an assignment or test.

Students and instructors are responsible for making themselves aware of and abiding by the “Western Michigan University Sexual and Gender-Based Harassment and Violence, Intimate Partner Violence, and Stalking Policy and Procedures” related to prohibited sexual misconduct under Title IX, the Clery Act and the Violence Against Women Act (VAWA) and Campus Safe. Under this policy, responsible employees (including instructors) are required to report claims of sexual misconduct to the Title IX Coordinator or designee (located in the Office of Institutional Equity). Responsible employees are not confidential resources. For a complete list of resources and more information about the policy see www.wmich.edu/sexualmisconduct.

In addition, students are encouraged to access the Code of Conduct, as well as resources and general academic policies on such issues as diversity, religious observance, and student disabilities:

Office of Student Conduct www.wmich.edu/conduct
Division of Student Affairs www.wmich.edu/students/diversity
University Relations Office http://www.wmich.edu/policies/religious-observances-policy
Disability Services for Students www.wmich.edu/disabilityservices