CPET-561 Embedded System Design

Spring 2020

****This syllabus has been updated for online classes the rest of the Spring 2020 semester****

Class Meeting:

Lecture Discussions Mondays & Wednesdays 4:00pm – 4:50pm – MyCourses discussion board
Lab Assistance Mondays or Wednesdays 2:00pm – 3:50pm – Via Skype

Instructor:

Holly Dickens
Office: GOL-1345
Phone: 585-475-5236
Office hours: Posted on MyCourses
Email: hldiee@rit.edu

Course Description:

This is an embedded systems architecture and design course. Microprocessor, as well as system level design principles will be analyzed from both a hardware and software perspective. Assembly language and C are used to develop software applications for a 32-bit embedded processor. Application software emphasizes interrupt driven operation and peripheral interfacing. A hardware description language (VHDL) is used to design and debug embedded components for an FPGA-based system.

Students, upon successful completion of the course, will be able to design and debug hardware and software systems, evaluate design trade-offs and choose the best design solution, and perform functional and timing analysis of an embedded system.

Pre-Requisite: CPET-251/2 (Microcontoller Systems & Lab), CPET-341/2/3 (Hardware Description Language & Lab)

Co-Requisite: CPET-561L (Embedded System Design Laboratory)

Intended Learning Outcomes:

1. Design embedded systems using softcore processor
2. Use version control to track changes and implement features
3. Use I/O devices and peripherals
4. Interface and size different memory devices
5. Implement custom intellectual property cores
6. Design and implement custom busses and interfaces protocols
7. Properly constrain designs using timing analysis
8. Use benchmarking to measure hardware acceleration and design improvements

Course Grading Policy:

- Weekly Demos - 20%

  Demos will be assigned and collected weekly. Each demo will be graded for completeness and accuracy. Submit video demos to MyCourses for grade.

- Weekly Discussions - 10%

  Lecture worksheets will be posted and evaluated weekly. Each worksheet will be graded pass/fail. The worksheet should be submitted via MyCourses dropbox.

- Hour Exams (2) - 20%

  There will be two 50 minute exams given during class time. Make-up exams will only be allowed for extreme circumstances. If you have a conflict, please make arrangements ***prior*** to the exam date. Exam 2 and the final will be given via MyCourses.

- Final Examination - 20%

  The final examination day and time are set by the university and may not be changed unless there is a direct conflict with another exam or you have more than 2 exams in one day. Any student with an A or an A- in ESD may choose to be exempt from the final exam and receive their current grade.

- Labs -30%

  You MUST past the lab section of this course with a 60% to pass ESD1. Labs will be assigned and collected as indicated in the lab schedule posted on mycourses. Each lab will be graded for completeness and accuracy. Lab write-ups, videos, and supporting documents will be submitted to the MyCourses dropbox for signoffs.
  Each lab will have equal weight toward the final lab grade.
  Final Day to Submit Labs for ESD1 is Tuesday 4/28 at 11:59PM
  Late demonstration of the lab will be subject to follow penalties:
  - After 1 week : 10 pt. penalty
  - After 2 weeks: 25 pt. penalty
  - After 3 weeks: No labs will be accepted

- Final Letter Grade

  Your final letter grade for the class will be based on the following scale that has been determined by the ECTET department:

93.00 – 100.00	A
90.00 – 92.99	A-
87.00 – 89.99	B+
83.00 – 86.99	B
80.00 – 82.99	B-
77.00 – 79.99	C+

73.00 – 76.99	C
70.00 – 72.99	C-
60.00 – 69.99	D
00.00 – 59.99	F

- Grade Dispute

  If you feel that you have been unfairly graded on any test or assignment, you will have 2 weeks from the time the work is returned to your mail folder to meet with me about it. It is your responsibility to check your mail folder regularly.

Course Supplies:

- There is no official text book for this class. Demos will replace the standard HW assignments.
- Altera DE1-SoC development board. See Ken or Chris for board rental (ENT-3128).
- Altera Quartus Prime Lite Edition Software v18.1

Remember RIT Resilience

Success depends heavily on your personal health and well-being. **Recognize** that stress is an expected part of the college experience, and it often can be compounded by unexpected setbacks or life changes outside the classroom. Your instructors strongly encourage you to **reframe** challenges as opportunities for growth. **Reflect** on your role in taking care of yourself throughout the term, before the demands of exams and projects reach their peak. Please feel free to **reach out** to your professors about any difficulty you may be having that may impact your performance as soon as it occurs and before it becomes unmanageable. In addition to your academic advisor, you are strongly encouraged to contact a number of other support services on campus that stand ready to assist you.

Academic Accommodations:

"RIT is committed to providing reasonable accommodations to students with disabilities. If you would like to request accommodations such as special seating or testing modifications due to a disability, please contact the Disability Services Office. It is located in the Student Alumni Union, Room1150; the website is www.rit.edu/dso. After you receive accommodation approval, it is imperative that you see me during office hours so that we can work out whatever arrangement is necessary."

Academic Dishonesty:

Students are encouraged to study together, but must do their own work. All students are required to submit original work. It is Plagiarism in any form will not be tolerated. All work is to be performed individually. At a minimum, plagiarism will result in a grade of 0% for that assignment as well as documentation of such being entered into the students' permanent records. If you are unclear as to what is considered plagiarism, please refer to the handbook:

"Writing with Sources" by Gordon Harvey. This is on reserve in the library.

Policy C 6.0 Policy Prohibiting Discrimination and Harassment/Title IX Reporting:

RIT is committed to providing a safe learning environment, free of harassment and discrimination as articulated in our university policies located on our governance website. RIT's policies require faculty to share information about incidents of gender based discrimination and harassment with RIT's Title IX coordinator or deputy coordinators, regardless whether the incidents are stated to them in person or shared by students as part of their coursework.
If you have a concern related to gender-based discrimination and/or harassment and prefer to have a confidential discussion, assistance is available from one of RIT's confidential resources on campus (listed below).

1. The Center for Women & Gender: Campus Center Room 1760; 585-475-7464; CARES (Available 24 hours/7 days a week) Call or text 585-295-3533.
2. RIT Student Health Center – August Health Center/1st floor; 585-475-2255.
3. RIT Counseling Center - August Health Center /2nd floor - 2100; 585-475-2261.
4. The Ombuds Office – Student Auxiliary Union/Room 1114; 585-475-7200 or 585-475-2876.
5. The Center for Religious Life – Schmitt Interfaith Center/Rm1400; 585-475-2137.
6. NTID Counseling & Academic Advising Services – 2nd Floor Lynden B. Johnson; 585-475-6468 (v), 585-286-4070 (vp).

Lecture Schedule:

Date	Week	Lecture Assigned	Demo Assigned
16-Mar	NA	Spring Break	No Assignment/Exam
23-Mar	9	Audio Basics Pipelining	Demo 8: Audio
30-Mar	10	Static Timing Bus Structure	No Assignment/Exam
6-Apr	11	Review/ Catch Up Exam 2	Demo 9 : TimeQuest
13-Apr	12	I2C/SPI/USB DMA	Demo 10: Arbitration p1
20-Apr	13	Clock Domain Crossing Buffers and FIFOs	Demo 11: Arbitration p2
27-Apr	Finals	Review/Catch Up Exam	

Lab Schedule:

Date	Week	Monday	Wednesday
16-Mar	N/A	Spring Break	Spring Break
23-Mar	9	Lab 6: RAM IP	Lab 7: RAM Interfacing
30-Mar	10	Lab 7: RAM Interfacing	Catch Up
6-Apr	11	Catch Up	Lab 8: Digital Filter Design
13-Apr	12	Lab 8: Digital Filter Design	Lab 9: Avalon Switch
20-Apr	13	Lab 9: Avalon Switch	Catch Up
27-Apr	Finals	Catch Up	

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