

# ECE 5990: RFID Systems

Fall 2014      **TTh: 11:40pm – 12:55pm**      Classroom: Hollister 368

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Weekly Events	Tuesday	Thursday
Fall semester starts on 8/28	<b>8/26</b> Class Introduction Syllabus and Notes	<b>8/28</b> History of RFID and vision of “Internet of Things” Notes
Project group preparation	<b>9/2</b> Technical overview of RFID operations Chap. 1	<b>9/4</b> Air Protocol Regulation Chap. 2
	<b>9/9</b> System components: tag, reader and network Chap. 2	<b>9/11</b> Near-field RFID systems Notes
Homework 1 due	<b>9/16</b> No Class	<b>9/18</b> UHF antennas Chap. 3
Homework 2: Individual project proposal	<b>9/23</b> UHF antennas Chap. 3	<b>9/25</b> ID storage; eNVM Chap. 4
Homework 3 due	<b>9/30</b> eNVM and write-once memory Notes	<b>10/2</b> Tag components: General Chap. 4
	<b>10/7</b> Tag components: UHF Notes	<b>10/9</b> Reader components Chap. 5
Homework 4 due	<b>10/14</b> Fall break: No class	<b>10/16</b> No class
Project Proposal due	<b>10/21</b> Reader components Chap. 5	<b>10/23</b> Air protocol Chap. 7
Prelim Exam	<b>10/28</b> Air protocol Chap. 8	<b>10/30</b> Prelim exam
Homework 5 due	<b>11/4</b> Present RFID protocol standards: IP-X and EPC Chap. 9	<b>11/6</b> Read range and rate optimization Chaps. 11 and 14
	<b>11/11</b> RFID positioning Chap. 15	<b>11/13</b> RFID positioning Chap. 15
Group presentation	<b>11/18</b> Group presentation	<b>11/20</b> Group presentation
	<b>11/25</b>	<b>11/27</b>

	Coding for RFID security Chaps. 16 and 17	Thanksgiving: No class
Final written report due	12/2 Coding for RFID security Chaps. 16 and 17	12/4 Main challenges ahead Chaps. 14 and 18

**Makeup Class:** There will be 2 – 4 makeup classes or labs to be arranged due to lecturer’s travel.

**Prerequisites:** ECE 2200 and 3150. ECE 3030, 4330, 4530, 4670 and 5790 are helpful, but not required.

**Course Description:** This course is aimed to give an overview of the **radio-frequency identification (RFID)** system, including the component technology, network protocols and main applications. Although ubiquitous RFID deployment or the so-called Internet-of-Things (IoT) has been proposed for quite a long time, serious research and commercial efforts have just been booming for less than a decade. Many countries in East Asia, Europe and North America have now dedicated special initiatives and strategic research to the RFID system and its broad potential applications in logistics, security/privacy, intelligent infrastructure, healthcare management, independent living, transportation, food traceability, and product lifecycle monitoring.

**Cornell Blackboard site:** ECE 5990 Special Topics in ECE Kan E (13203\_2014FA), self enrollment.

**Required textbook:** M. Bolic, D. Simplot-Ryl and I. Stojmenvoic, *RFID Systems: Research Trends and Challenges*, 2010. ISBN: 978-0-470-74602-8

**Recommended books:** V. D. Hunt, A. Pugilia and M. Pugilia, *RFID: A Guide to Radio Frequency Identification*, 2007; D. M. Dobkin, *The RF in RFID: UHF RFID in Practice*, 2<sup>nd</sup> Ed., 2012.

**Grades:** Homework (10%), prelim exam (25%), three-page project proposal (10%), project presentation (15%), final report with individual team oral exam (40%)

**Course outcomes:**

1. The student can perform simulation of mixed-signal circuits and electromagnetic propagation for RFID components.
2. The student can make system design and evaluation from component and network specifications.
3. The student can apply the RFID solutions to various logistic and monitoring applications, and is able to evaluate the system advantages and cost structure.

**Project Planning:**

1. Project group preparation: The semester will start with individual student introduction about their related background and RFID applications of interest. Each student will turn in a mock project proposal (counted as a homework assignment) that will be given simple feedback and then posted on the class web page for all to view.
2. Group formation and project proposal: Three students of similar interest and complementary background should form a group and put together a two-page project proposal (including the proposed quantitative analysis and at least 3 major references). The instructor will give feedback within a week.
3. Project presentation: Each group will give a 15-min presentation plus a 5-min Q&A in class. The presentation and the slides will be graded and given feedback.
4. Project report: Each group will turn in a double-space 10-page report. Notice that there has to be a part of “quantitative” analysis. All cited materials should be carefully referenced.
5. Oral exam: Each group will set up a time with the instructor to have an oral exam on the project presentation and report. The exam will start with individual questions (no help for each other) and then group questions. Feedback to individuals and of the entire project will be given at the end of the oral exam as well.