ECE 4114: Software Defined Radio Design Laboratory

Credits and contact hours: 3 Credits (One four-hour lab per week)

Instructor: Shengli Zhou

Textbook: none
   a. *Other supplemental materials*: Lab manuals are handed out at the beginning of each lab.

*Specific course information***:**
   a. *Catalog Description*: Design and experimental evaluation of analog and digital communication systems based on software defined radio platforms. Typical subject areas are amplitude modulation (AM), frequency modulation (FM), amplitude shift keying (ASK), frequency shift keying (FSK), and phase shift keying (PSK), orthogonal frequency division multiplexing (OFDM), channel equalization, wireless local area networks, and ad hoc networks.

   b. *Prerequisite*: ECE 3101; ECE 4111 or ECE 4112, which may be taken concurrently. Open only to students in the School of Engineering.

   c. *Required, elective, or selected elective:* Selected elective (EE)

*Specific goals for the course***:**
   a. *Specific outcomes of instruction*: Students will be able to apply the fundamental techniques of software defined radio, using the Universal Software Radio Peripheral (USRP) platforms and the LabView programming language. Students will be able to conduct various lab experiments on AM, FM, ASK, FSK, PSK and gain valuable hands-on experience on those popular communication methods. Students will complete a project, establishing digital communication links in the lab environment.

   b. *ABET Criterion 3 Student Outcomes addressed by the course*:

      (1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
      n/a

      (2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
      n/a

      (3) an ability to communicate effectively with a range of audiences
      Students write lab reports on the design/operation/analysis of communication techniques.

(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
n/a

(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
n/a

(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
Students learn to conduct experiments on key communication concepts (learned from ECE 4111 and ECE 4112) on the software defined radio platforms. Practical issues such as carrier frequency shifts, packet detection, timing and phase compensation are encountered and visualized, and students learn how to address those issues and demonstrate their solutions.

(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
Students use the web, software community forums, and other resources for completing their lab assignments and reports.

Topics covered:
- Introduction to LabView
- Introduction to USRP
- AM (amplitude modulation)
- FM (frequency modulation)
- ASK (amplitude shift keying)
- FSK (frequency shift keying)
- PSK (frequency shift keying)
- Standalone digital transceivers to form an adhoc network
- OFDM (orthogonal frequency division multiplexing), if time permits