**San José State University**

# School/Department Course Number, Title, Section, Semester, Year

## Course and Contact Information

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| **Instructor**: | Hua Harry Li, Ph.D. |
| **Office** **Location**: | Engineering Building, Rm 267A |
| **Telephone**: | (408) 924-4060 |
| **Email**: | h[ua.li@sjsu.edu](mailto:Hua.li@sjsu.edu) or hualili@yahoo.com |
| **Office Hours**: | Tuesdays and Wednesdays 3:00-4:00 PM |
| **Class Days/Time**: | Mondays and Wednesdays 12:00 – 1:10 PM |
| **Classroom**: | Engr Building Room 331 |
| **Prerequisites**: | CMPE 240 or equivalent |

## Course Format

One evening lecture a week and one self-organizing lab session a week. Use development kit is required for the lab work.

## Course Description (Required)

The course combines wireless communications and embedded system architecture. It covers basic communication theory and techniques (ASK, FSK, xPSK, xQAM, OFDM), as well as protocols (IEEE 802.11a/b/g/n etc) In addition, it covers embedded systems suitable for portable, wireless communications, such as ARM CPU and its derivatives. Total 4 to 5 hands-on design and implementation labs will be assigned.

## Course Goals (Optional)

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| --- | --- |
| CLO 1 | Understand Embedded Wireless Systems Architecture |
| CLO 2 | Understand Base Band Signal and its frequency characteristics; |
| CLO 3 | Understand modulation techniques such as ASK, FSK, PSK and their implementations in IEEE wireless communication protocols. |
| CLO 4 | To be able to design and implement MAC layer coding techniques and build real working embedded wireless systems |

### Course Learning Outcomes (CLO) (Required)

*Insert and list your non-General Education course goals and learning outcomes here. Describe the outcome in terms of specific and measurable actions, capabilities or skills students will be able to perform through course activities/experience at the end of your course. Add any additional program or department outcomes if appropriate.*

Upon successful completion of this course, students will be able to:

1. *Insert learning outcome 1*
2. *Insert learning outcome 2, etc.*

## Required Texts/Readings (Required)

### Textbook

1. Reference: Wireless Network Evolution, 2G to 3G, V.K. Garg, Prentice Hall, PTR,2002.
2. Professor Li’s handout materials;
3. IEEE 802.11x standards
4. Datasheets, lab design reference materials will be posted

### Other Readings

* 1. The reference material for ARM CPU hardware features, application notes, class handouts and lab assignments and reports are posted at SJSU CANVAS and github <https://github.com/hualili>

## Course Requirements and Assignments (Required)

Quizzes and midterm are not postponed or retaken under any circumstances. The only exception is medical emergencies accompanied with doctor’s report. The lab reports can be delayed under special circumstances. If you know you will delay a report for some unavoidable reason please see me as soon as possible.

Include University’s Credit Hour Requirement below.

“Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.”

### Final Examination or Evaluation

Final are not postponed or retaken under any circumstances. The only exception is medical emergencies accompanied with doctor’s report. The lab reports can be delayed under special circumstances. If you know you will delay a report for some unavoidable reason please see me as soon as possible.

## Grading Information

Quiz and/or Homework 5%

Midterm Examination 25%

Laboratory 30%

Final Examination 40%

### Determination of Grades

* A statement of how grades will be determined for the course, including +/- grades if they are used.
* Extra credit options, if available.
* List of the percentage weight assigned to various class assignments.
* Penalty for late or missed work: 10% per week.

## Classroom Protocol

Students are required for participation, attendance will be checked on each class, and no late arrival is allowed. No food or drinks during the class, no cell phone use during the class.

## University Policies (Required)

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs’ [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at http://www.sjsu.edu/gup/syllabusinfo/”

* + 1. **Academic integrity**

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The [University’s Academic Integrity policy](http://www.sjsu.edu/senate/S07-2.htm), located at http://www.sjsu.edu/senate/S07-2.htm, requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The [Student Conduct and Ethical Development website](http://dev.sjsu.edu/studentconduct/) is available at http://www.sa.sjsu.edu/judicial\_affairs/index.html.

Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person’s ideas without giving proper credit) will result in a failing grade and sanctions by the University. For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU’s Academic Policy S07-2 requires approval of instructors.

* + 1. **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the [Disability Resource Center](http://www.drc.sjsu.edu/) (DRC) at http://www.drc.sjsu.edu/ to establish a record of their disability.

# Course Number / Title, Semester, Course Schedule

*List the agenda for the semester including when and where the final exam will be held. Indicate the schedule is subject to change with fair notice and how the notice will be made available.*

## Course Schedule

| **Week** | **Date** | **Topics, Readings, Assignments, Deadlines** |
| --- | --- | --- |
| 1 | First Week | Organizational Meeting and Introduction. Introduction to embedded wireless communications, overview of IEEE 802.11b standard and software defined radio to implement software for MAC layer functions. Concept of cognitive radio. |
| 2 | First Week | Design of a prototype system for software defined radios. Base band signals and its characteristics in frequency domain. Synchronization techniques. |
| 3 | First Week | Design and implementation of synchronization techniques, LISA algorithms for base band signals, and implementation of LISA on the prototype system. Fourier Transform, Modulation/Demodulation. |
| 4 | First Week | Scrambling and de-scrambling techniques for synchronization, and its software implementation on Rx/Tx RF modules of the prototype system. |
| 5 | First Week | Modulation/Demodulation. Introduction to ASK, FSK, and PSK techniques, prototype board implementation to spread the spectrum for better communication performance. |
| 6 | First Week | Time-Frequency domain analysis, Base-band signal analysis. |
| 7 | First Week | Source coding techniques, Huffman coding and arithmetic coding, and their implementation on the wireless prototype system. |
| 8 | First Week | Midterm Examination |
| 9 | First Week | Channel correction coding techniques. Linear Block Coding Techniques and its software implementation for the Rx/Tx RF modules. |
| 10 | First Week | Discussion of PSK modulation technique, and improvement of PSK, introduce BPSK, QPSK, and DQPSK techniques and system architecture for their modulation and demodulation. |
| 11 | First Week | CCK techniques and it mathematic description, software implementation of CCK technique. |
| 12 | First Week | Software implementation of CCK techniques and discussion of implementation of CCK on Rx and Tx RF modules, performance comparison. |
| 13 | First Week | Cognitive radio techniques, information theory and performance index for wireless communications, spread spectrum technique. |
| 14 | First Week | Implementation of Cognitive Radio and frequency hopping. |
| 15 | First Week | Comparison of IEEE 802.11a/b/g/n techniques. |
| 16 | First Week | Research project presentations and demos |
| Final Exam |  | Comprehensive final |