## ECE 449 - Object-oriented Programming and Computer Simulations

**Credits:** 3, **Contact Hours:** Two 75 minute lecture session per week.

**Coordinator:** J. Wang, Associate Professor of ECE

**Textbook:** Koenig. A. and Moo, B.E. *Accelerated C++: Practical Programming by Example*, Addison-Wesley, 2000.

**2019 Catalog Data:** ECE 449: Object-oriented Programming and Computer Simulation. Credit 3.
The use of object-oriented programming to develop computer simulations of engineering problems. Programming with the C++ language in a UNIX environment. OOP concepts including classes, inheritance, and polymorphism. Programming with classes, inheritance, and polymorphism. Programming with class libraries. Event-driven simulation techniques in an object-oriented environment. Programming projects will include the development of a simulator for an engineering application. (3-0-3) **(P)**

**Prerequisites or co-requisites by topic:** CS 116, CS 350 or ECE 242, senior standing.

**Enrollment:** Elective course for EE majors; computer systems/software elective course for CPE majors.

**Specific outcomes of instruction:**
After completing this course, the student should be able to do the following:

1. Identify objects and their interactions for computer simulation.
2. Utilize object lifetime for resource management considering object composition, inheritance, and exception handling.
3. Understand typical computer simulation algorithms.
4. Reuse existing class libraries to improve code quality and productivity.
5. Utilize class invariants to design class types. Document and validate pre-conditions and post-conditions via assertions.
6. Construct reusable class libraries using polymorphism.
7. Utilize design patterns when designing and reusing class libraries.
8. Design and implement a computer simulator following test-driven and iterative/incremental software engineering practices.

**Relationship of ECE 449 specific outcomes of instruction to student outcomes:**

| | **Student Outcomes** | **Course Goals** |
|---|---|---|
| 1 | An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics | 1,2,3,4,5,6,7, 8 |
| 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 | 2,4,5,6,7,8 |
| 3 | An ability to communicate effectively with a range of audiences | |
| 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 | |
| 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 | |
| 6 | An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions | 5,8 |
| 7 | An ability to acquire and apply new knowledge as needed, using appropriate learning strategies | 8 |

**Topics:**

- Introduction to C++ and computer simulation (1 week)
- String and file I/O (1 week)
- Abstract data types and functions (1 week)
- Standard template library (2 weeks)
- Class invariants and class design (1 week)
- Resource management (1 week)
- Object composition and exception safety (1 week)
- Cycle simulation (1 week)
- Inheritance and runtime polymorphism (1 week)
- Design patterns (1 week)
- Event-driven simulation (1 week)
- Templates and compile-time polymorphism (1 week)
- Smart pointer (1 week)
- Final Exams (1 weeks)

**Laboratory topics:** **None**

**Prepared by:** J. Wang **Date:** February 28, 2020