**Computer Science**

**Department Faculty**
John Hunt

**Department Goals**

This is an exciting time to be involved in computer science and information technology. Recent developments coupled with the promise of future advances provide strong motivation for engaging the discipline at all levels.

The department fully embraces the College purpose of educating with Christ preeminent and bringing all things captive to Him. All disciplines of study are to be engaged including the study of computation in its many forms and computer science more specifically. Every effort is made to have the students in the program relate their computer science content to their Christian worldview.

To ensure a rigorous academic standard in computer science courses, the current joint curricular guidelines of the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronic Engineers (IEEE) are used in the development of those courses and their content. The current standard implemented is that approved in 2008.

The department goals include:

1. the offering of the major in Computer Science;
2. the offering of a minor in Computer Science;
3. the offering of department courses needed by other majors to enhance those programs;
4. the offering of a Unix based server for programs requiring this operating and computing environment. This server configuration is a dual AMD 64 bit dual core system supporting Sun Microsystems’s Solaris (Unix) operating system with a substantial disk farm and memory. Majors have access to this server as well as a wealth of other computing tools and resources.

The programs offered provide a balanced consideration of theory and application within the computing sciences. Faculty are genuinely interested in working directly with students to facilitate timely progress in the development of knowledge and skills in the discipline. We invite all who have interest in computer science and related disciplines to inquire.

**Requirements for Major in Computer Sciences**

The core and distribution requirements for a major in computer science are those listed for baccalaureate degrees on page 24.

- Core requirements ...............................................................58
- Electives ...............................................................................21

**Major Course Requirements**

- COS 130. Computer Programming Methodology ................ 4
- COS 150. Advanced Programming Methodology ................ 4
- COS 230. Data Structures and Algorithms ......................... 4
- COS 250. Introduction to Computer Organization .............. 4
- COS 260. Ethical and Professional Issues in Computing “W” 3
- COS 300. Database Systems ................................................. 4
- COS 325. Operating Systems and Network Programming ... 4
- COS 350. Programming Languages .................................... 4
- COS 375. Software Engineering or
  - COS 380. Personal Software Engineering ........................ 4
- COS 425. Foundations of Computer Science .................... 4
- COS 492. Senior Integration Paper ...................................... 2
- ENG 252. Speech ‘S’ .......................................................... 2
- STA 251. Elementary Statistical Methods .......................... 4
- Total hours for the major ................................................ 47
- Total degree hours.............................................................126

**Requirements for Minor in Computer Science**

- COS 130. Computer Programming Methodology ................ 4
- COS 150. Advanced Programming Methodology ................ 4
- COS 230. Data Structures and Algorithms ......................... 4
- Two additional COS courses .............................................. 8
- Total hours for the minor ................................................ 20

**Computer Sciences Courses**

**130. Computer Programming Methodology**

Designed for majors in computer science and minors in computer science and computer information systems. This course introduces the student to a general methodology for computer programming. Course content includes problem solving techniques, algorithm development, structured and object-oriented programming methodology, pseudo-code, data types, selection, iteration, and arrays. Elementary file structures are also examined. Prerequisite: MAT 141. Four hours.

**131. Computing for Engineers**

Foundations of computing with an introduction to design and analysis of algorithms and an introduction to design and construction of programs for engineering problem-solving. The MATLAB software will be used as the programming language of choice for pre-engineering students. Prerequisite: MAT 141. Four hours.

**150. Advanced Programming Methodology**

This course examines programming methods of greater sophistication. Topics include data abstraction, data structures, and simple recursion. Program design issues including commonality and variability analysis, coupling, and cohesion will be examined. Object oriented (OO)
techniques such as data hiding and polymorphism will be emphasized. This course provides the necessary foundation for further study in computer science. Prerequisite: COS 130. Four hours.

230. Data Structures and Algorithms
This course provides an in-depth study of data structures and algorithms. Data structure topics include: stacks, lists, queues, trees, and graphs. Algorithms include: various sorts and searches, greedy, divide and conquer, Dijkstra, etc. Programming techniques will include multi-way recursion. Big O notation for the analysis of techniques will be emphasized. Prerequisite: COS 150. Four Hours

250. Introduction to Computer Organization
This course is an introduction to computer organization with an emphasis upon viewing the computer in a hierarchical fashion, with virtual machines built on top of the features of lower level virtual machines. There will be an emphasis upon interactions among hardware, software, firmware, and operating systems. The basic organization of a computer; its central processing unit, memory, and input/output devices all tied together by a system bus, will be learned in theory, and that theory will be applied in practice to understanding the more important computer architectures of today. Students will also learn to program in C/C++, with those languages being used as a means of communicating many of the ideas in the course. Prerequisite: COS 230. Four hours.

260. Ethical and Professional Issues in Computing
Considers the impact of computer use on society. Discusses ethical use of software and protection of intellectual property rights. Profession is viewed historically; organizations important to the profession are discussed; the development process for standards is presented; and students are introduced to professional literature. Topics will include: technology in scripture; distinctions between technology and science, technology and economics, technology and development; mankind’s use of technology in relation to the cultural mandate; and man as a creator. A major topic will be the responsibility of professionals based an examination of the IEEE / ACM professional code of ethics. 3 hours. ‘W’

299. Special Topics
Opportunities for study in various topics of interest within the field of computer science. These may be short-term courses offered during the semester or during the summer term. Topics will be decided by the department faculty as need and interest arise. Prerequisites: to be determined. Credit to be determined.

300. Database Systems
A study of the nature and application of database processing. The physical representation of databases, the primary structured models used in organizing a database, commercially available database management systems, and the factors involved in implementing and using a database are covered. Students will design and work with a database using one of the database management systems on the Covenant College computing network. Prerequisite: COS 150. Four hours.

325. Operating Systems and Network Programming
This course will look at issues of concurrency including its two best known applications: operating systems and network programming. The course provides an introduction to operating systems, their function, development, structure, and implementation. A general model of operating systems functions and development will be studied. In addition, an introduction to data communication networks, including the Open Systems Interconnection (OSI) model will be provided. Hands on work will include the use of Interprocess Communication methods (IPC), process and thread creation and management, and Remote Procedure Call (RPC). Prerequisite: COS 250. Four hours.

350. Programming Languages
A survey of the significant features of existing and experimental programming languages with particular emphasis on grammars, syntax, semantics, notation, parsing, and storage arrangements. Selected examples of general purpose and special purpose languages are studied. In addition the course will cover discrete math for computing. Specifically, sets, functions, combinations, and permutations. Prerequisite: COS 250. Four hours.

375. Software Engineering
An overview of the tools, metric techniques, and team-oriented methodologies necessary to support the development of large systems and application software will be given. A group project consists of the study and implementation of a large software system of the type expected in industry. This type of project requires a high degree of interaction and communication among team members, as well as rigorous coding techniques. Prerequisite: COS 150. Four hours.

380. Personal Software Engineering
Course provides an introduction to software engineering with a focus on development process. Development process will focus on the stages of the development lifecycle including requirements, architecture, design, testing, verification and validation. Design will include an introduction to patterns. The effect of team dynamics and the need for project management will be discussed. A special focus will be made on developing professional work habits based on the Software Engineering Institutes (SEI) Personal Software Process (PSP). Prerequisite: COS 230. Four hours.

425. Foundations of Computer Science
Development of the theoretical foundations of programming: algorithms, languages, automata, computability, complexity, data structures; a broad range of fundamental topics are
consolidated and extended in preparation for further study. The course includes an introduction to information theory: the understanding of the quantification of data, particularly in regards to its reliability. Implications of these theories will be developed in relation to such topics as artificial intelligence and linguistics. Prerequisite: COS 230. Four hours.

450. Special Topics
A course offered on a subject of particular interest but unlisted as a regular course offering. The course is open to appropriate students by class standing, background, or interest, depending on the topics. All offerings are at the discretion of the department. The department uses this course to provide majors and other departments and groups with topics of current interest which are timely in the student’s development in computer science as well as other disciplines. Possible topics include artificial intelligence, the Internet, neural networks, parallel processing, expert systems, and computer graphics. Prerequisites and credit hours will vary.

492. Senior Integration Paper in Computer Science
An independent study required of all students majoring in computer science. The student will explore and analyze a topic related to the student’s area of interest in computer science in the light of Christian worldview. The study will result in a written thesis. Prerequisites: COS 230, Senior standing or approval by the instructor. Two hours.