CS 6, Virtual Worlds and Game Programming 3 units
Transfer: CSU
- Prerequisite: CS 3.

Using Alice, an authoring tool, students will build interactive, animated 3-D virtual worlds. Virtual worlds are interactive, simulated environments that accept human input and provide output in the form of images, sounds, and forces. The software students create will enable them to move around in the virtual world and see it from different angles. Students will create interactive “virtual worlds,” games and simulations that can be viewed in a web page. By building these virtual worlds, students will learn the basics of Object-Oriented programming and basic programming logic.

CS 8, Systems Analysis and Design 3 units
Transfer: UC, CSU
- Prerequisite: Any computer programming course.

This advanced course requires students to be proficient in programming. Students with little programming experience are encouraged to take additional programming courses before enrolling in this course.

In this course students learn how to design a software system from data collection, analysis and design to final output including forms, flowcharts, and documentation. It covers the tools and techniques used in analysis, design, and project management, such as the preparation of systems specifications, detail system designs, Gantt charts, and data-flow diagrams. In this course students develop a complete system; however this course does not cover any programming concepts.

CS 9A, Technology Project Management I 3 units
Transfer: CSU
- Prerequisite: CS 3 or CIS 1.

This course covers the fundamentals of Project Management theory, implementation, and best practices. It is aimed at students who work mostly in the Technology sectors covering software and website development, and other areas of computer science or information systems. Students will learn the theory, as well as the use of Project Management software to plan, track and manage project resources. Topics covered include project life cycles, tasks, schedules, resources, and costs. CS 9A is the same course as CIS 9A. Credit may be earned for one, not both.

CS 9B, Technology Project Management II 3 units
Transfer: CSU
- Prerequisite: CS 9A or CIS 9A.

This course covers advanced topics of Project Management theory and practice. Students will learn how to manage projects with changing tasks and schedules, and to adjust their resources and budgets. Also covered are leadership and communication skills. Students will complement the theory with case studies and the use of Project Management software. CS 9B is the same course as CIS 9B. Credit may be earned for one, not both.

CS 10, Discrete Structures 3 units
Transfer: UC, CSU

IGETC AREA 2 (Mathematical Concepts)
This course is intended for computer science, engineering, and mathematics majors. Topics include proof techniques, cardinality of sets, partial orderings and equivalence relations, symbolic logic and valid arguments, permutations and combinations with repetition, and an introduction to graph theory. Computer Science 10 is the same course as Math 10. Students may receive credit for one, but not both.

**CS 15, Visual Basic Programming** 3 units
Transfer: UC, CSU
• Prerequisite: CS 3.

This introductory course covers basic programming constructs and techniques using VB.Net. Students will learn how to plan, create and debug code based on Object Oriented Programming design and analysis techniques. Topics covered include Data Types, Variables, Decision Statements, Loops, Arrays Input/Output, and basics of Object Oriented Programming using Classes and Objects. VB.Net compiler software is included in course material. This course helps students pass Microsoft Certification Exams.

**CS 17, Assembly Language Programming** 3 units
Transfer: UC, CSU
• Prerequisite: CS 50.

Assembly Language allows the programmer to fully utilize all of the special features of the computer in the most efficient manner. It also aids the high-level language programmer in writing subroutines. The student will write Assembly Language programs that utilize the Intel Pentium chip architecture. Students must have access to a Pentium-chip compatible computer system. Software included in course material.

**CS 18, Advanced Assembly Language Programming** 3 units
Transfer: UC, CSU
• Prerequisite: CS 17.

This course is a continuation of Assembly Language Programming. The student will write complex assembly programs utilizing the full range of the computer’s features. Problem solving through planning coding, testing, and debugging will be emphasized. Students must have access to a Pentium-chip compatible computer system. Software included in course material.

**CS 19, Advanced Visual Basic Programming** 3 units
Transfer: UC, CSU
• Prerequisite: CS 15.

This course covers advanced programming techniques using Visual Basic .NET. Topics include Structures, Classes, Events, Inheritance, and Polymorphism, Overloading, Dynamic Binding, Multiple Document Interface, Windows API, Collections, and Exception Handling. Students also learn how to interface to Databases and build Web forms. VB.Net compiler software is included in course material. This course helps students pass Microsoft Certification Exams.

**CS 20A, Data Structures with C++** 3 units
Transfer: UC, CSU
• Prerequisite: CS 52.

This advanced programming course will use the C++ language to teach methods of representing and manipulating data within a computer. Topics include stacks, queues, trees, sorting, searching, modeling, and dynamically created storage spaces. Students will learn the problem solving skills necessary to write complex computer programs and to make important software design and maintainability decisions. Software included in course material.

**CS 20B, Data Structures with Java** 3 units
Transfer: UC, CSU
• Prerequisite: CS 56.

This course is an introduction into the study of computer algorithms and data structures. This advanced programming course will use the Java language to teach methods of representing and manipulating data within a computer. Topics include stacks, queues, trees, sorting, searching, modeling, and dynamically created storage spaces. Students will learn the problem solving skills necessary to write complex computer programs and to make important software design and maintainability decisions.

**CS 22, Introduction to Mobile Robots** 3 units
Transfer: CSU
• Prerequisite: CS 3.

This course describes the hardware, software, and operation of mobile robots that interact with changing environments. Hardware includes computers and other controllers, motors and artificial muscles, arms, grippers, ultrasonic sensors, whiskers, and cameras. Using a graphical interface on a PC, students will learn to program and operate a robot that can recognize objects and speech, talk back, and navigate around a cluttered room.

**CS 25, Embedded Systems** 3 units
Transfer: CSU
• Prerequisite: CS 3.

This is an introductory course on embedded systems design- the use of computers in devices (cell phones, cars, wrist watches, home security systems, etc.) rather than as stand-alone units. Students are directed to design solutions for real world applications using hardware and software. We will discuss the characteristics that define an embedded system and contrast those against that of a stand-alone computer. Students will also look at a variety of applications utilizing embedded processors (microcontrollers). Finally, students will write programs that interact directly with external hardware utilizing a Stamp microprocessor development board.

**CS 32, Database Programming in Visual Basic.Net** 3 units
Transfer: UC, CSU
• Prerequisite: CS 15.

VB.Net is an object-oriented programming language that is part of the .Net Microsoft suite. It provides a graphical programming environment used to create applications for Microsoft Windows and the Web. This course covers advanced concepts for VB .NET that relate to interfaces to databases. Topics include
Object Oriented Programming, database interfaces programming, SQL query language, using LINQ and EM, and applying security measures in connections.

VB .NET compiler software is included in course material.

**CS 33, C# Programming** 3 units
Transfer: UC, CSU
- **Prerequisite:** CS 19 or CS 50.
  
  C# (read as C-Sharp) is a modern object-oriented language that enables programmers to quickly build solutions for the Microsoft.NET platform. In this class, programmers will learn to build C# components for use by Web and Windows-based applications. Students will generate MSIL (Microsoft Intermediate Language) code and PE (Portable Executable) files that utilize the services of the CLR (Common Language Runtime) which are all part of the Microsoft .NET platform.
  
  Software included in course material. This course helps students in passing Microsoft Certification Exams.

**CS 36, Fortran Programming** 3 units
Transfer: UC, CSU
- **Advisory:** CS 3.
  
  FORTRAN is a high level language used predominantly in mathematical and scientific applications. Upon completion of CS 36, students will understand the syntax and semantics of FORTRAN, be able to apply the fundamental principles of top down algorithmic design (using pseudocode and flowcharts) to the solution of computer problems, and know how to code, test, and debug programs in this language.

**CS 37, Web Programming in VB .Net** 3 units
Transfer: UC, CSU
- **Prerequisite:** CS 15.
  
  VB.Net is an object-oriented programming language that is part of the .Net Microsoft suite. This course covers web application development, including the use of ASP and VB .NET. Topics include ASP .NET, Web forms and controls, web data access, state management, web services, using AJAX and security measures implementation.

**CS 40, Operating Systems** 3 units
Transfer: UC, CSU
- **Prerequisite:** CS 17.
  
  This course provides a functional understanding of operating systems. Topics include memory and process management under multiprogramming, devices and file systems, and user interfaces. Foundation concepts reviewed at the outset include hardware architecture, CPU instruction sets and machine language, number systems, data structures. UNIX is used to demonstrate concepts, commands, and programming languages.

**CS 41, Linux Network Administration** 3 units
Transfer: CSU
- **Prerequisite:** CS 50.
  
  This is a foundation course in the Linux operating. Booting a Linux machine is dissected, from BIOS firmware to authenticated user shell. Use of shell commands, editors, programming tools, and GUIs are emphasized. Students learn to write shell script programs and install applications using the open source software distribution model. Unix process creation is detailed and a 20-line tutorial shell is developed. Local administration tasks are covered, including user account management, backup, task scheduling, logging, and clock time synchronization. As time allows recompilation of the kernel from source code will be performed.

**CS 42, Computer Architecture** 3 units
Transfer: UC, CSU
- **Prerequisite:** Math 20.
  
  This course provides an introduction to fundamental operations and components that make computers possible. Topics include: number systems; Boolean algebra and logic gates (AND, OR, NOT, XOR, and NAND); simplification of Boolean functions; combination logic; sequential logic; design of the adder, subtractor, ROM, decoder, and multiplexer; register transfer logic; and processor logic, control logic, and microcomputer system design.

**CS 43, Windows Network Administration** 3 units
Transfer: CSU
- **Prerequisite:** CS 70.
  
  This course provides students with the knowledge necessary to understand and identify the tasks involved in supporting Microsoft Windows Networking Operating Systems. It covers topics such as installing and configuring Windows Servers to create File, Print, Web, and Terminal servers, and manage and support a network infrastructure that uses the Microsoft Windows Server products. The course also focuses on Windows Active Directory services, implementing Group Policy and performing the Group Policy related tasks that are required to centrally manage users and computers.

**CS 50, C Programming** 3 units
Transfer: UC, CSU
- **Prerequisite:** CS 3.
  
  This course will include a review of the concepts of structured programming, error checking, sorting, searching, data types, advanced array handling methods, pointers, and data structures. Applications in business, mathematics, and science will be discussed.

**CS 51, Visual C++ Programming** 3 units
Transfer: UC, CSU
- **Prerequisite:** CS 52.
  
  C++ handles large programs by packaging sections of interrelated code into discrete, independent parts named objects. Visual C++ adds the Microsoft Foundation Class library making it a powerful Windows programming tool. This course will cover Dynamic Link Libraries, advanced view handling, customizing status bars, operator overloading OLE containers and servers, the Microsoft Foundation class library, serialization, windows timers, graphics, metafiles, multiview programs, graphics display controls, and screen capture.
  
  Software included in course material.

**CS 52, C++ Programming** 3 units
Transfer: UC, CSU
- **Prerequisite:** CS 50.
This course is a continuation of C language programming using the C++ superset of C. C++ offers the following enhancements to C: operator and function overloading, information hiding, inheritance, and virtual functions. C++ will be used in the context of both traditional and object-oriented programming.

Software included in course material.

**CS 54, Object-Oriented Analysis and Design** 3 units

Transfer: UC, CSU

- Prerequisite: CS 19 or 52 or 55.

This course covers the major object-oriented modeling methodologies: UML, OMT and BOOCH. The course explores the use of these methodologies in the context of designing and implementing object-oriented software application.

Software included in course material.

**CS 55, Java Programming** 3 units

Transfer: UC, CSU

- Prerequisite: CS 19 or 50.

Java is a general-purpose language for writing platform-independent, robust, secure programs. This course is intended for students who have completed a course in C programming. Students will learn how to develop Java applications and applets. Topics covered include the Java programming language, object-oriented programming (OOP), the Java applications programming interface (API), and graphical user interfaces (GUI’s).

**CS 56 Advanced Java Programming** 3 units

Transfer: UC, CSU

- Prerequisite: CS 55.

Java is a general-purpose language for writing platform-independent, robust, secure programs. This course continues where CS 55 leaves off in developing mastery of the use of Java programming language and its extensive APIs. Topics covered include exceptions, multithreading, multimedia, Input/Output, Java Database Connectivity (JDBC), Servlets, Remote Method Invocation (RMI), and networking.

**CS 60, Database Concepts and Applications** 3 units

Transfer: CSU

- Prerequisite: CS 3 and one programming course.

This course introduces modern database concepts while emphasizing the relational database model. Topics include design methodologies, normalization of tables to reduce redundancies, supertypes and subtypes to reduce nulls, data integrity, referential integrity, and using locks and other techniques for concurrency control in a multi-user database. Factors that should be balanced during the design of a database are described. To document databases, entity relationship diagrams, relational schemas, and data dictionaries are described. Principles are applied by performing exercises using MySQL or other database management system. SQL and other languages are used to create and fill tables, retrieve data, and manipulate it by stored programs.

**CS 61, Microsoft SQL Server Database** 3 units

Transfer: CSU

- Prerequisite: CS 3.

Microsoft SQL Server is a popular midrange relational database management system (DBMS) that is used in client/server systems and as a personal DBMS. It can be accessed through the Internet. Topics covered in this course include installing the software, principles of relational databases; creating databases, tables, indexes, and views; inserting, deleting, and updating raw data; updating transactions; and querying the database. With the Transact-SQL extensions, topics include creating functions, procedures, and triggers stored in the database.

**CS 65, Oracle Programming** 3 units

Transfer: CSU

- Prerequisite: CS 3 and one programming class.

This course is a practical, hands-on overview of the Oracle Database Management System to store, retrieve, and manipulate data. Oracle is a widely used database that runs on PC’s, minicomputers, and mainframes, and Oracle programmers and developers are very much in demand. Oracle’s SQL is used to create and alter tables with various constraints. Data is retrieved and manipulated by using SELECTS that can group data and retrieve data from several tables by joining them or by using set operations. Views are created. PL/SQL, with its variables, symbolic constants, IF statements, and loops is used to program stored functions, stored procedures, and triggers. Cursors and error handling (exceptions) are introduced.

**CS 66, Advanced Oracle** 3 units

Transfer: CSU

- Prerequisite: CS 65.

This course expands on topics covered in the basic Oracle course. The topics include SQL, SQL*Plus, Developer 2000, and DBA tasks. In addition, it will cover in detail the varied aspects of Designer 2000, a software suite instrumental in analyzing, designing, and building large scale Oracle applications.

**CS 68, Oracle Database Administrator** 3 units

Transfer: CSU

- Prerequisite: CS 65.

This course offers hands-on experience as a Database Administrator (DBA) using an Oracle server. Topics include a DBA’s responsibilities, Oracle architecture, installing Oracle software, configuration options, managing RAM and disk space, managing database changes, managing transactions, tuning and monitoring database resources such as space, transactions, memory, and file usage.

**CS 70, Network Fundamentals and Architecture** 3 units

Transfer: CSU

- Prerequisite: One programming course.

This course offers a broad introduction to networking concepts and analyzes different network architectures. Introductory topics include network topologies, media and signaling, protocols, addressing, and distributed networks. The varied ways to connect computers are explored as are the resulting architectures. The course explores subnetting, both physical and virtual and internetworks are constructed in the lab. Server programs are introduced to demonstrate their signature socket-API struc-
ture. Specific real-world services such as the apache web server, BIND name server, NFS and Samba file system servers, DHCP address server, and others are discussed.

CS 71, Introduction to Windows NT Workstation 3 units
Transfer: CSU
• Prerequisite: CS 70.

This course is an introduction to the Windows NT Operating System. Topics include installation and configuration of the Windows NT Workstation, files and directories, security structures, TCP/IP and NetWare connectivity, printing, performance tuning, and troubleshooting.

CS 73, Computer Security Concepts 3 units
Transfer: CSU
• Prerequisite: CS 3 or CIS 1.

In this introductory course students will learn how to defend and protect critical computer assets from various security threats including computer worms and viruses. This course will describe fundamental techniques and principles for modeling and analyzing security. Students will learn how to express security requirements, translate requirements into policies, implement mechanisms that enforce policy, and ensure that these policies are effective. Current industry best practices for safeguarding computer resources will be discussed. Various case studies will outline the typical way that security failures get exploited by attackers and how these attacks can be discovered, understood, and countered.

CS 74A, Security in VB.NET Applications 3 units
Transfer: CSU
• Prerequisite: CS 15.

This course provides students with the tools needed to implement security in designing and developing applications written in Microsoft Visual Basic .NET. Topics include encryption, security practices, securing remote applications such as ASP and remote databases. Upon completion of this course, students will be able to develop applications that can handle threats and respond to them more securely.

CS 74B, Security in J2EE Applications 3 units
Transfer: CSU
• Prerequisite: CS 55.

This course provides students with the tools needed to implement security in designing and developing applications utilizing the Java 2 Platform. Topics include encryption, security practices, securing remote applications such as secure web servers and remote databases. Upon completion of this course, students will be able to develop applications that can handle threats and respond to them more securely.

CS 75, Network Protocols and Analysis 2 units
Transfer: CSU
• Prerequisite: CS 70.

This course introduces major protocols and their roles in protocol suites with emphasis on TCP/IP. Detailed coverage is given to at least one protocol at each layer, the main application level protocols and at least one security protocol. Analytic programs such as ping, traceroute, and packet capture are studied and applied as tools to protocol analysis. The Wireshark packet capture and protocol decoder program is centrally utilized.

CS 78, Secure Server Installation and Administration 3 units
Transfer: CSU
• Prerequisite: CS 70.

In this course students will study network service administration. This course covers physical BIOS and bootloader security, password strength and cracking, file system permissions, authentication mechanisms, remote backup and logging, and installation strategies as machine-level security considerations. A variety of particular service applications like Apache (an HTTP service) and BIND (name service) are then studied, emphasizing their strengths, weaknesses, and how to configure them for security through wrappers, file system access jails, and other mechanisms.

CS 80, Internet Programming 3 units
Transfer: CSU
• Prerequisite: CS 3.

This course surveys the many technologies that are used to program multitiered, client/server, database-intensive, Web-based applications. Topics include: XHTML, Cascading Style Sheets (CSS), JavaScript, Extensible Markup Language (XML), RSS, Ajax, Rich Internet Applications, Web servers, databases, MySQL, PHP, Ruby on Rails, Active Server Pages (ASP), JavaServer Faces, and Web Services.

CS 81, JavaScript and Dynamic HTML 3 units
Transfer: CSU
• Prerequisite: CS 80.

This introductory programming course teaches the fundamentals of computer programming with the JavaScript language, the standard for client-side Web programming. It offers a thorough treatment of programming concepts with programs that yield visible or audible results in Web pages and Web-based applications. It shows how to use Core and Client-Side JavaScript and the Document Object Model to build interactive, high-performance Web sites. This course uses JavaScript which is open-source (free) software.

CS 82, ASP.NET Programming in C# 3 units
Transfer: CSU
• Prerequisite: CS 33.

Server-side Web programming allows programmers to create content and process data supplied in Web forms to create websites. These applications process data submitted from Web forms and access backend databases to dynamically generate Web pages. Students will design and write web pages using ASP 2.0 (Active Server Pages), Visual Studio. NET and the C# programming language.

CS 83, Server-Side Java Web Programming 3 units
Transfer: CSU
• Prerequisite: CS 55 and CS 81.

This course teaches how to design and write applications that extend Web servers. These applications process data submitted from Web forms and access backend databases to
dynamically generate Web pages. This course covers the Java Servlets and JavaServer Pages (JSP) server-side technologies.

**CS 84, Programming with XML**  
*3 units*  
Transfer: CSU  
**Prerequisite:** CS 80 and CS 55 or CS 52 or CS 33.  
XML (Extensible Markup Language) is a flexible way to create "self-describing data" and to share both the format and content on the World Wide Web, intranets and elsewhere within an enterprise. In this advanced course, students will use XML and learn to tag and transform XML documents so that they can be processed by web browsers, databases and other XML processors. With the industry-standard SAX and DOM API standards, students will create XML applications that read, write and modify XML documents.  
*This course uses PHP and MySQL which are open-source (free) software.*

**CS 85 PHP Programming**  
*3 units*  
Transfer: CSU  
**Prerequisite:** CS 81.  
This course teaches how to design and write applications that extend Web servers. These applications process data submitted from Web forms and access back-end databases to dynamically generate Web pages. This course covers the PHP server-side technology. PHP, which stands for "PHP: Hypertext Preprocessor" is a widely-used, Open Source, general-purpose scripting language that is especially suited for Web development and can be embedded into HTML.  
*This course uses PHP and MySQL which are open-source (free) software.*

**CS 86, Android Development**  
*3 units*  
Transfer: CSU  
**Prerequisite:** CS 55  
**Skills Advisory:** CS 56  
This course teaches how to design, develop, test, and debug applications that run on Android, a software stack for mobile devices that includes an operating system, middleware and key applications. Topics include the Android Software Development Kit (SDK), design principles, application structure, strings, graphics, user interfaces, animation, storage, networking, telephony, Location-Based Services (LBS), multimedia, 3D graphics, notifications, and services.

**CS 88A, Independent Studies in Computer Science**  
*1 unit*  
Transfer: CSU  
Please see "Independent Studies" section.

**CS 88B, Independent Studies in Computer Science**  
*2 units*  
Transfer: CSU  
Please see "Independent Studies" section.

**CS 88C, Independent Studies in Computer Science**  
*3 units*  
Transfer: CSU  
Please see "Independent Studies" section.