## UNDERGRADUATE PROGRAMS

Computer Science is an exciting and rapidly evolving discipline involving the study of computing systems and computation. Computing systems are now a critical component in nearly every field. As computer applications have increased in number and complexity, so has the need for specialists in computer systems and software. Research in computer science continues to broaden and extend our knowledge and provide new opportunities.

The study of computer science is a challenging and satisfying intellectual activity that can be carried forward into graduate school and throughout one's life. Our graduates achieve a high degree of success in building careers in both public and private sectors.

### Facilities and Equipment

- **The Animation Production Studio**: equipped with professional grade software and hardware, this lab houses our motion capture system and offers students an excellent environment for creating and developing quality animation, computer games and multimedia applications.
- **Center for Network Computing and Cyber Security**: this lab contains support materials and hardware for computer science courses in secure client/server network programming, web server security, network intrusion detection and computer forensics.
- **Computer Architecture and Embedded Systems**: resources and equipment are available to supporting studies in architecture and embedded systems.
- **Classroom Labs**: these teaching labs provide hands-on instructional capabilities for Computer Science and Computer Literacy courses.
- **Lower Division Computer Science Lab**: this study lab supports lower division students, staffed by peer tutors.
- **Upper Division Computer Science Lab**: this study lab is designed to support junior and senior level Computer Science projects in software design; client/server application development; relational database design and administration; and signal processing.

### Opportunities for Students: upper-division majors should check on EagleAXIS for opportunities for work-study and departmental positions as course assistants, paper graders, or tutors.

Many of our students are able to obtain internships where the theory and skills learned in the academic setting are put to the test. Internships allow you to gain new knowledge and understanding of current practices. An internship experience is an excellent opportunity to refine your career aspirations and make valuable contacts for future employment.

All students in our programs are encouraged to join the student chapter of the Association for Computing Machinery (ACM). This group sponsors colloquia, field trips, programming contests and social events. Membership in the student chapter is the beginning of a long-term opportunity to connect with professionals in your chosen field.

### UNDERGRADUATE PROGRAMS

**COMPUTER SCIENCE FOUNDATIONS OPTION**

The Bachelor of Arts degree in Computer Science—Foundations Option provides a solid foundation in the practice of computing, while allowing you to expand your education with coursework in other disciplines. The program will prepare you for a career in software development, and is of particular interest if you wish to pursue interdisciplinary applications of computing that are not covered by any of our other degrees.

**BACHELOR OF ARTS (BA)**

Student Learning Outcomes for the BA in Computer Science, Foundations Option, may be found at www.ewu.edu/csslo

### COMPUTER SCIENCE FOUNDATIONS OPTION

The Bachelor of Arts degree in Computer Science—Foundations Option provides a solid foundation in the practice of computing, while allowing you to expand your education with coursework in other disciplines. The program will prepare you for a career in software development, and is of particular interest if you wish to pursue interdisciplinary applications of computing that are not covered by any of our other degrees.

**Note**: two years of a single high school foreign language or one year of a single college level foreign language is required.

**Note**: students are encouraged to choose CMST 340 Intercultural Communications or CMST 344 Gender and Communications to fulfill their cultural and gender diversity requirement and/or CMST 440 Global Communications to fulfill their international studies requirement.

#### Required Computer Science Courses

- CSCD 210 Programming Principles I (5)
- CSCD 211 Programming Principles II (5)
- CSCD 240 C and Unix Programming (5)
- CSCD 300 Data Structures (5)
- CSCD 320 Algorithms (4)
- CSCD 327 Relational Database Systems (4)
- CSCD 330 Computer Networks (4)
- CSCD 349 Design Patterns (4)
- CSCD 350 Software Engineering (4)
- CSCD 488 Senior Project (5)
- CSCD 490 Senior Capstone (5)

Each computer science course must be completed with a minimum grade of 2.0. All supporting courses required by the department must be completed with a minimum grade of 2.5.

#### Preparation: High school students wishing to pursue a major in this department are advised to take as much mathematics as possible, including a course or courses in your senior year. You will benefit from computer science courses available in your high school but do not take them at the expense of mathematics courses. You also are encouraged to take laboratory science courses and a keyboarding course.

Community college transfer students interested in Computer Science should pursue mathematics courses through pre-calculus or beyond, as well as an advanced sophomore level composition course. Consult transfer guides at www.ewu.edu/transferguide to determine whether your institution has developed agreements with Eastern for transfer equivalencies, and which courses are equivalent for general education requirements and courses that may apply to the major. Contact the department for advice on selecting your preparatory coursework. Courses taken to apply to the major should be taken late in your community college experience, just prior to transferring to EWU.

All prospective department majors should contact the Department of Computer Science to obtain the latest information to aid in planning a program of study. See grade requirements below.

**Major Declaration**

Freshman and transfer students entering Eastern with an interest in the computing sciences are encouraged to declare their major as soon as practical. To declare a major, complete the declaration form found at access.ewu.edu/Documents/Records-Reg/MajorDeclarationForm.pdf, print, sign, and bring it or official or unofficial copies of all non-EWU college-level work to a meeting with a computer science advisor. You may contact an advisor for an appointment At the advising session you will have the opportunity to review course requirements, ask questions, prepare a quarterly schedule and finish the major declaration, which also requires agreeing to abide by the department's Code of Ethics and Professional Conduct, which is available on the department's website, access.ewu.edu/computer-science/code-of-ethics.xml.

**Grade Requirements**

As a computer science student, you are expected to maintain an overall university GPA ≥ 2.5. Each computer science course must be completed with a minimum grade ≥ 2.5. All supporting courses required by the department must be completed with a minimum grade ≥ 2.0.

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**Faculty:** T. Capaul, K. Inamura, B. Kamp, R. Lemelin, D. Li, C. Peters, R. Pickett, P. Schimpf, S. Steiner, D. Tappan, C. Taylor, Y. Tian, B. Xu.
**BACHELOR OF COMPUTER SCIENCE (BCS)**

Student Learning Outcomes for the BCS may be found at [www.ewu.edu/csslo](http://www.ewu.edu/csslo)

**COMPUTER SCIENCE MAJOR**

Our Bachelor of Computer Science program provides significant formal training in database and web programming, unique internship opportunities, and team development of information system projects. The program is designed to help prepare you to realize the potential of information systems. You can enjoy a career as a systems analyst, database administrator, web developer or software engineer.

**Required Computer Science Courses**
- CSCD 216 Programming Principles I (5)
- CSCD 211 Programming Principles II (5)
- CSCD 240 C and Unix Programming (5)
- CSCD 300 Data Structures (5)
- CSCD 320 Algorithms (4)
- CSCD 327 Relational Database Systems (4)
- CSCD 330 Computer Networks (4)
- CSCD 340 Operating Systems (5)
- CSCD 349 Design Patterns (4)
- CSCD 350 Software Engineering (4)
- CSCD 488 Senior Project (5)
- CSCD 490 Senior Capstone (5)

**Choose one of the following courses**
- CSCD 370 Graphical User Interface Programming (4)
- CSCD 371 .NET Programming (4)
- CSCD 372 Android Mobile Development (4)
- CSCD 373 iOS Mobile Development (4)

**Choose one of the following**
- CSCD 378 Web Application Development (4)
  - or CSCD 379 .NET Web Application Development (4)

**Choose one of the following**
- CSCD 427 Advanced Database Management Systems (4)
  - or CSCD 429 Data Mining (4)

**Required Supporting Courses**
- MATH 301 Discrete Mathematics (5)
- MATH 308 Elementary Probability and Statistics (5)
- PHIL 212 Introduction to Ethics (5)

**Required Focus Group—choose group A, B, or C**

**Group A—Game Development**
- CSCD 216 3D Modeling and Animation I
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 474 Computer Games Development (4)
- MATH 231 Linear Algebra

**Group B—Animation**
- ART 300 Drawing (5)
- CSCD 216 3D Modeling and Animation I (4)
- CSCD 416 3D Modeling and Animation II (4)
- CSCD 417 3D Modeling and Animation III (4)
- DESN 216 Digital Foundations (4)

**Group C—any CSCD department approved minor**

Electives—three additional electives from the following

**Note:** CSCD 95–99 courses may be used—prior departmental approval of topic content is required.

Note: many of these elective courses have prerequisites.

Note: any course used as a requirement may not also be used as an elective.

Note: CSCD 316 must be taken twice for 4 credits total to be used as an elective.

- CSCD 303 Computer and Information Security (4)
- CSCD 305 C++ Programming (4)
- CSCD 316 Practical Problem Solving (2, 2)
- CSCD 340 Operating Systems (5)
- CSCD 370 Graphical User Interface Programming (4)
- CSCD 371 .NET Programming (4)
- CSCD 372 Android Mobile Development (4)
- CSCD 373 iOS Mobile Development (4)

**Minimum total required credits for above major**

88 credits

**Electives—choose two from the following**

**Note:** CSCD 95–99 courses may be used—prior departmental approval of topic content is required.

Note: CSCD 316 must be taken twice for 4 credits total to be used as an elective.

Note: students are encouraged to choose CMST 340 Intercultural Communications or CMST 314 Gender and Communications to fulfill their cultural and gender diversity requirement and/or CMST 440 Global Communications to fulfill their international studies requirement.

Note: any course used as a requirement may not also be used as an elective.

Note: many of these elective courses have prerequisites.

- CSCD 303 Computer and Information Security (4)
- CSCD 305 C++ Programming (4)
- CSCD 316 Practical Problem Solving (2, 2)
- CSCD 370 Graphical User Interface Programming (4)
- CSCD 371 .NET Programming (4)
- CSCD 372 Android Mobile Development (4)
- CSCD 373 iOS Mobile Development (4)
- CSCD 378 Web Application Development (4)
- CSCD 427 Advanced Database Management Systems (4)
- CSCD 429 Data Mining (4)
- CSCD 430 Automata (4)
- CSCD 427 Advanced Database Management Systems (4)
- CSCD 429 Data Mining (4)
- CSCD 433 Advanced Computer Networks (4)
- CSCD 434 Network Security (4)
- CSCD 435 Principles of Programming Languages (4)
- CSCD 437 Secure Coding (4)
- CSCD 440 Advanced Operating Systems (4)
- CSCD 443 Distributed Multiprocessing Environments (4)
- CSCD 460 Advanced Architecture and Organization (4)
- CSCD 461 Embedded Systems (4)
- CSCD 462 Embedded Real-Time Control (4)
- CSCD 467 Parallel and Cloud Computing (4)
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 471 Advanced 3D Computer Graphics Programming (4)
- CSCD 474 Computer Games Development (4)
- CSCD 480 Intelligent Systems (4)
- CSCD 487 Human Computer Interface (4)
- CSCD 495 Internship (up to two 4 credit internships are allowed)
COMPUTER SCIENCE

COMPUTER SCIENCE MAJOR

The Bachelor of Science degree in Computer Science is accredited by the Computing Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202, 410.347.7700.

Our traditional computer science degree provides extensive preparation in both the theoretical and practical aspects of computer science. It will prepare you for a variety of careers in computing or for additional study at the graduate level. In this program you will study both general purpose programming and programming for specialized purposes and environments. In addition, you will learn about algorithms, performance analysis, networks, computer architectures, information systems and software engineering. You will also work on a realistic project in a team environment. The program includes a variety of advanced courses that allow you to tailor your degree to your specific interests.

Required Computer Science Courses

- CSCD 427 Advanced Database Management Systems (4)
- CSCD 429 Data Mining (4)
- CSCD 433 Advanced Network Concepts (4)
- CSCD 434 Network Security (4)
- CSCD 435 Principles of Programming Languages (4)
- CSCD 437 Secure Coding (4)
- CSCD 443 Distributed Multiprocessing Environments (4)
- CSCD 460 Advanced Architecture and Organization (4)
- CSCD 461 Embedded Systems (4)
- CSCD 467 Parallel and Cloud Computing (4)
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 471 Advanced 3D Computer Graphics Programming (4)
- CSCD 474 Computer Games Development (4)
- CSCD 480 Intelligent Systems (4)
- CSCD 487 Human Computer Interface (4)
- CSCD 495 Internship (up to two 4 credit internships are allowed)

Minimum total required credits for above major 112 credits

BACHELOR OF SCIENCE (BS)

Student Learning Outcomes for the BS in Computer Science may be found at www.ewu.edu/csslo

COMPUTER SCIENCE continued

Required Supporting Courses

- EENG 160 Digital Circuits (4)
- MATH 161 Calculus I (5)
- MATH 162 Calculus II (5)
- MATH 231 Linear Algebra (5)
- MATH 301 Discrete Math (5)
- MATH 380 Elementary Probability and Statistics (5)
- PHL 212 Introduction to Ethics (5)

Required Laboratory Science Courses, choose one sequence from the following

- Biology
  - BIOL 171 Biology I (5)
  - BIOL 172 Biology II (5)
  - BIOL 270 Biological Investigation (3)
- Chemistry
  - CHEM 151 General Chemistry I (5)
  - CHEM 152 General Chemistry II (5)
- Geology
  - GEOL 120 Physical Geology–The Solid Earth (5)
  - GEOL 121 Physical Geology–Surficial Processes (5)
- Physics
  - PHYS 151 General Physics I (4)
  - PHYS 152 General Physics II (4)
  - PHYS 161 Mechanics Laboratory (1)
  - PHYS 162 Heat and Optics Laboratory (1)
  - PHYS 163 Instrumentation Lab I (1)
  - PHYS 164 Instrumentation Lab II (1)

Natural Science Breadth
Any 5 credit course that satisfies a natural science GECR in a discipline other than that chosen for the sequence above.

Required Electives–choose at least one course from Group A and one course from Group B.

Note: many of these elective courses have prerequisites.
Note: other 300- or 400-level courses require prior approval of the department.
Note: students are encouraged to choose CMST 340 Intercultural Communications or CMST 314 Gender and Communications to fulfill their cultural and gender diversity requirement and/or CMST 440 Global Communications to fulfill their international studies requirement.

Group A

- CSCD 303 Computer and Information Security (4)
- CSCD 305 C++ Programming (4)
- CSCD 316 Practical Problem Solving (2, 2+) or CSCD 379 .NET Web Application Development (4)
- CSCD 320 Algorithms (4)
- CSCD 327 Relational Database Systems (4)
- CSCD 330 Computer Networks (4)
- CSCD 340 Operating Systems (5)
- CSCD 349 Design Patterns (4)
- CSCD 350 Software Engineering (4)
- CSCD 488 Senior Project (5)
- CSCD 490 Senior Capstone (5)

Choose one of the following

- CSCD 370 Graphical User Interface Programming (4)
- CSCD 371 .NET Programming (4)
- CSCD 372 Android Mobile Development (4)
- CSCD 373 iOS Mobile Development (4)
- CSCD 374 Computer Games Development (4)
- CSCD 375 Human Computer Interface (4)
- CSCD 379 .NET Web Application Development (4)
- CSCD 381 Data Mining (4)
- CSCD 389 Advanced Operating Systems (4)
- CSCD 415 3D Modeling and Animation I (4)
- CSCD 416 3D Modeling and Animation II (4)
- CSCD 417 3D Modeling and Animation III (4)
- CSCD 418 3D Modeling and Animation IV (4)
- CSCD 435 Principles of Programming Languages (4)
- CSCD 437 Secure Coding (4)
- CSCD 439 Advanced Operating Systems (4)
- CSCD 440 3D Computer Graphics Programming (4)
- CSCD 451 Embedded Real-Time Control (4)
- CSCD 462 Distributed Operating Systems (4)
- CSCD 467 Parallel and Cloud Computing (4)
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 471 Advanced 3D Computer Graphics Programming (4)
- CSCD 480 Intelligent Systems (4)

Minimum total required credits for above major 133 credits

Group B—must choose at least one course from the following list

- BIOL 173 Biology III (5)
- CHEM 153 General Chemistry III (5)
- GEOL 122 Historical Geology (5)
- MATH 163 Calculus III (5)
- MATH 241 Calculus IV (5)
- MATH 370 Survey of Geometries (5)
- MATH 401 Advanced Formal Logic (5)
- PHIL 301 Introduction to Formal Logic (5)
- PHYS 153 General Physics III (4)
- PHYS 154 General Physics IV (4)
- PHYS 161 Mechanics Laboratory (1)
- PHYS 162 Heat and Optics Laboratory (1)
- PHYS 163 Instrumentation Lab I (1)
- PHYS 164 Instrumentation Lab II (1)

Minimum total required credits for above major 133 credits
MINORS
Students in nearly any major may wish to choose one of the minors below, which provide basic instruction in computing that is useful in a wide variety of fields.

Note: students must earn a grade ≥ 2.5 in each required computer science course and a grade ≥ 2.0 in each supporting course in the minors.

3D ANIMATION MINOR
The minor provides the skills necessary to meet an increasing demand for 3D modeling and animation developers. Included is the study of 3D modeling, 3D animation, character animation, animation scripting and advanced animation tools.

Required Courses
CSCD 110 Introduction to Programming (5)
CSCD 216 3D Modeling and Animation I (4)
CSCD 416 3D Modeling and Animation II (4)
CSCD 417 3D Modeling and Animation III (4)
DESN 216 Digital Foundations (4)

Minimum total credits for above minor 21 credits

COMPUTER APPLICATIONS MINOR
The minor will give you knowledge of a variety of computer applications. After completion of the core computer literacy courses, you select additional elective courses covering computer applications. Through choice of elective courses you can explore a variety of topics such as educational software, web page development, art, business, mathematics and technology applications.

Required Courses (12 credits)
CPLA 120 Computer Applications Literacy (5)
CPLA 121 Intermediate Computer Applications Literacy (5)
CPLA 215 Internet and WWW Basics (2)

Electives—choose from the following courses (16–18 credits)
ART 303 Digital Art I (5)
ART 403 Digital Art II (5)
CSCD 411 Multimedia Techniques (4)
DESN 263 Visual Communication Design I (5)
DESN 360 Publication Design (4)
DESN 368 Web Design I (4)
MENG 217 3D Parametric Computer Aided Design (4)
MISC 211 Information Technology in Business (4)
MISC 374 Spreadsheet Modeling for Business Applications (4)
MISC 379 .NET Web Application Development (4)

Minimum total credits for above minor 28 credits

COMPUTER INFORMATION SYSTEMS MINOR
Demand for computer skills, including database management and design, make this minor a good choice in support of a variety of majors.

Note: advancement programming exam clearance is required for CSCD 427 and CSCD 429.

Required Courses (24 credits)
CSCD 210 Programming Principles I (5)
CSCD 211 Programming Principles II (5)
CSCD 300 Data Structures (5)
CSCD 327 Relational Database Systems (4)
MATH 301 Discrete Mathematics (5)

Elective: choose one of the following (4 credits)
CSCD 427 Advanced Database Management Systems (4)
CSCD 429 Data Mining (4)

Minimum total credits required for above minor 28 credits

COMPUTER SCIENCE PROGRAMMING MINOR
This minor provides a solid core of computer science knowledge in support of other fields of inquiry and employment.

Required Courses (20 credits)
CSCD 210 Programming Principles I (5)
CSCD 211 Programming Principles II (5)
CSCD 300 Data Structures (5)
MATH 301 Discrete Mathematics (5)

Electives (8–10 credits)
Choose two courses from approved CSCD courses (at least 8 credits). Prior departmental approval required. Advancement Programming Exam clearance may be required.

Minimum total credits required for above minor 28 credits

GAME DEVELOPMENT MINOR
This minor provides a strong computer programming foundation followed by courses that emphasize game programming skills.

Required Courses (28 credits)
CSCD 210 Programming Principles I (5)
CSCD 211 Programming Principles II (5)
CSCD 216 3D Modeling and Animation I (4)
CSCD 300 Data Structures (5)
CSCD 474 Computer Games Development (4)
MATH 301 Discrete Mathematics (5)

Minimum total credits required for above minor 28 credits

WEB APPLICATION DEVELOPMENT MINOR
This minor provides a strong computer programming foundation followed by courses that emphasize design and programming skills needed to create and maintain websites.

Required Courses (22 credits)
CSCD 210 Programming Principles I (5)
CSCD 211 Programming Principles II (5)
CSCD 327 Relational Database Systems (4)
DESN 216 Digital Foundations (4)
DESN 368 Web Design I (4)

Elective—choose one of the following (4 credits)
CSCD 378 Web Application Development (4)
CSCD 379 .NET Web Application Development (4)

Minimum total credits required for above minor 26 credits

COMPUTER SCIENCE
GRADUATE PROGRAMS

MASTER OF SCIENCE IN COMPUTER SCIENCE

Dan Tappan, Program Advisor | 315 CEB | 509.359.7093 | dtappan@ewu.edu

Student Learning Outcomes—For the Master's in Computer Science may be found at www.ewu.edu/csslo

The Master's Program in Computer Science has been designed to provide opportunities for professional growth in this rapidly changing field. The program strives to provide a balance between practical applications-oriented content and a theoretical framework for continued learning.

Required: Continuous enrollment in at least 2 credits per term during the academic year.

Core requirements (25 credits)

This coursework provides core knowledge in the areas of algorithms, database systems, software engineering, operating systems and research methods.

CSCD 501 Advanced Algorithms (5)
CSCD 506 Research Methods in Computer Science (5)
Must be taken in the first year of the program.
CSCD 524 Advanced Software Engineering (5)
CSCD 527 Modern Database Systems (5)
CSCD 540 Advanced Operating Systems (5)

Electives (16 credits), at least one elective must be at the 500-level.

This coursework provides the student an opportunity to take courses specialized to their particular area(s) of interest. Any 400-level or non-Computer Science course must be approved by the Department of Computer Science graduate coordinator or the student's graduate committee chair. CSCD 695 cannot be used to satisfy any portion of these elective requirements. The courses CSCD 538, Topics in Computer Hardware and CSCD 539 Topics in Computer Science, may each apply more than once, provided distinct topics are studied.

Thesis, Project or Workplace Project (8 credits minimum)

The student is expected to expand their knowledge with a published thesis or to apply their knowledge to a significant project. Projects may be work-related. The thesis or project is defended in a final oral examination of the student's work.

Thesis option: CSCD 600 (at least 8)
Project option: CSCD 601 (at least 8)
Workplace project option: CSCD 595 (at least 4) + CSCD 602 (4)

Total credits for the above master’s degree 49 credits

Application/Admission Requirements—the petitioner must:

1. Meet all Eastern Washington University requirements for admission to graduate study;
2. Complete and submit the online application for graduate school (www.ewu.edu/grad/application-procedures);
3. Submit a completed departmental questionnaire (access.ewu.edu/computer-science/degree-information/mscs);
4. Supply transcripts showing completion of coursework covering the following areas:
   - Fundamental Programming (see CSCD 210, CSCD 211)
   - C Programming & Unix Operating System (see CSCD 240)
   - Data Structures, Algorithms: (see CSCD 300, CSCD 320)
   - Relational Database Systems: (see CSCD 327)
   - Operating Systems (see CSCD 340)
   - Design Patterns and Software Engineering (see CSCD 349, CSCD 350)
   - Discrete Mathematics (see MATH 301)
5. If you are not taking the GRE, it is important that you indicate all grades received in these courses, or their equivalents, on your departmental questionnaire in order to prevent delays in the processing of your application.

Provide a résumé:

- If you are not a graduate of a Computer Science degree from EWU, provide two letters of recommendation, at least one from a computer science instructor or equivalent;
- Submit a cover letter discussing your reasons for pursuing a master’s degree, the focus of knowledge you want to explore, and an evaluation of your ability to complete this degree;
- If you are an international student, provide a TOEFL score of 580 or greater (237 CBT, 92 iBT).

Note: 1. Applicants who have not completed the readiness courses may do so as post-baccalaureate students but may also petition for probationary graduate admission when they have less than a full-time load of readiness courses to complete.

Note: 2. Students needing to satisfy the requirements for CSCD 320 Algorithms, CSCD 340 Operating Systems or CSCD 350 Software Engineering at EWU will first need to pass the Computer Science Advancement Programming Exam.

Note: 3. Elective graduate courses may have prerequisites beyond the readiness requirements above and the student is responsible for mastering prerequisites before taking such courses. If the prerequisite course is not at the senior level it cannot be counted towards the graduate degree.

MASTER OF SCIENCE INTERDISCIPLINARY

In addition to the Master of Science in Computer Science the department participates in customized interdisciplinary master’s degree programs in cooperation with other departments. Call the department office for further information.

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Computer Literacy Courses

Terms offered: If no terms are indicated, check with the department or EagleNET.

Course fees will be required on many CPLA courses.

CPLA 100 Computer Literacy I (1)
Notes: graded Pass/No Credit; passing this course gives clearance of Computer Literacy Part I; does not count toward the 180 credit requirement.
Satisfies: pre-university basic skills, computer literacy.
This course is an introduction to computer concepts. Hardware, software and operating systems are presented on both Windows and Mac platforms. An introduction to word processing, presentation software and an introduction to basic Internet use are provided.

CPLA 101 Computer Literacy II (1)
Note: passing the literacy exam at the end of this course gives clearance of Computer Literacy Part II.
Prerequisite: CPLA 100 or Computer Literacy Part I clearance.
Satisfies: university competencies, computer literacy.
Students will be introduced to and develop skills in spreadsheets, databases and the process of locating informational and reference materials using simple and refined Internet searches. Students will explore societal issues of security, privacy, viruses and computer crime.

CPLA 120 Computer Applications Literacy (5)
Note: this course includes preparation for and testing of Computer Literacy I and II so that students may satisfy computer literacy requirements by taking this course and passing the literacy tests.
This course introduces students to fundamental computer concepts designed to give an overview of computers, the Internet and The World Wide Web. Students will develop knowledge and skills in word processing, presentation software, spreadsheets, databases, web page creation and locating informational and reference materials using simple and refined Internet searches. No previous computer background is assumed.

CPLA 121 Intermediate Computer Applications Literacy (5)
Prerequisites: CPLA 100 and 101 or CPLA 120.
A study of popular microcomputer software including, but not limited to word processing, electronic spreadsheet, database, desktop publishing, presentation graphics, Internet and Web tools. Course uses the Windows environment.

CPLA 199 Directed Study (1–5)
Prerequisite: permission of the instructor, department chair and college dean.

CPLA 215 Internet and WWW Basics (2)
Prerequisite: Computer Literacy II clearance.
Investigation of the Internet and The World Wide Web (WWW). Web searching and research techniques on the Web are presented. Each student will create a home page. Use of electronic mail, mailing lists, news readers and FTP will be explored. Issues associated with the Internet and WWW will be discussed including privacy and social impact. Projects utilizing the Internet and WWW are major parts of the course.

CPLA 396 Experimental Course (1–5)

CPLA 398 Seminar (2–5)

CPLA 496 Experimental Course (1–5)

CPLA 499 Directed Study (1–5)
Prerequisite: permission of the instructor, department chair and college dean.

CPLA 601 Project Report (2–16)
Prerequisite: permission of the instructor, department chair and college dean.
A research study in lieu of a bound thesis conducted as partial fulfillment of a master’s under the direction of a graduate committee.

CPLA 100 Computer Applications Literacy (5)
Prerequisites: CPLA 100 and 101 or CPLA 120.

Computer Science Courses

Terms offered: if no are indicated, check with the department or EagleNET.

Course fees will be required on many CSCD courses.

CSCD 110 Introduction to Programming (5)
Students learn fundamental programming concepts, programming environment topics and current technologies in computing. Programming concepts include structure and design using pseudo-code, basic syntax, variables, arithmetic, decisions, repetition, input and output. Programming environment topics include editor use, saving, running and debugging. Programming projects are required.

CSCD 196 Experimental Course (1–5)

CSCD 199 Directed Study (1–5)
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 210 Programming Principles I (5)
Prerequisites: ≥ 2.0 MATH 141 and previous programming experience HIGHLY RECOMMENDED.
This course covers the concepts and practices of information representation, computer algorithms, hardware organization and computer program design and implementation. Students write, run, debug, analyze and evaluate computer programs. Topics include primitive data types, number systems, file I/O classes, control structures, method design and usage, array–sorting and searching algorithms. Programming projects are required.

CSCD 211 Programming Principles II (5)
Prerequisites: CSCD 210 with a grade ≥ 2.5 or concurrent enrollment.
This course continues coverage of concepts introduced in Programming Principles I. Topics include 2D arrays, recursion, data abstraction, polymorphism, inheritance, interfaces, inner classes, abstract classes, object cloning, file I/O, exception handling and linked lists. Programming projects are required.

CSCD 216 3D Modeling and Animation I (4)
This course includes the fundamental concepts and implementation of 3D animation using current 3D modeling and animation software. Topics include basics of modeling, texturing and animation. This course requires 3D projects.

CSCD 240 C and Unix Programming (5)
Prerequisites: CSCD 211 with a grade ≥ 2.5 or concurrent enrollment.
This course includes program development tools of the UNIX operating system and syntax and programming techniques of the C language in that environment. UNIX topics include interactive shells, common text editors, utility programs, file system structure, library and operating system calls and system programming. C topics include data types, structures, pointers and pointer arithmetic, arrays, linked lists and function design and use. Programming projects are required.

CSCD 255 C Programming for Engineers (5)
Prerequisite: MATH 141 or math proficiency.
This course is an introduction to the C language in the context of beginning computer science concepts and engineering practices. Students will write, run, debug, analyze and evaluate C programs. Topics include primitive data types, number systems, file I/O, control structures, function design and usage, 1D arrays, sorting, searching and pointers. Programming projects are required.
CSCD 260  Architecture and Organization (4)  
Prerequisites: CSCD 240 with a grade ≥ 2.5, EENG 160 with a grade ≥ 2.0.
This course covers fundamentals of digital computer design and microcomputer systems. Topics include number systems, Boolean algebra, basic digital circuits, and an instruction set for a microprocessor. Homework assignments will include use of current software for the design, analysis and simulation of digital circuits, assembly language, programming, and an enrollment in the eight-year engineering program emphasizing I/O device access and features that support high level languages. Programming projects are required.

CSCD 298  Seminar (1–5)  
CSCD 299  Special Studies (1–5)  
permission of the instructor, department chair and college dean.
Subjects studied vary according to student and faculty interest.

CSCD 300  Data Structures (5)  
Prerequisites: CSCD 211 with a grade ≥ 2.5, MATH 301 with a grade ≥ 2.0.
This course covers fundamental abstract concepts of data structures as well as their implementation in a programming language. Topics include linked lists, stacks, queues, hashing, recursion, complexity analysis of algorithms, binary search trees and binary balanced trees. Programming projects with formal documentation are required.

CSCD 303  Computer and Information Security (4)  
Prerequisites: computer literacy clearance.
This course covers fundamentals of computing security, including threat types, how computers become infected with viruses and malware, how to avoid viruses and malware, and how to secure your computers and information stored on them. Possible topics include: operating system security, Internet security, virus and spyware scanners, browser tools, firewalls and other defensive techniques. The course includes hands-on practice with security tools and techniques.

CSCD 305  C++ Programming (4)  
Prerequisites: CSCD 240 with a grade ≥ 2.5 or CSCD 211 with a grade ≥ 2.5 and CSCD 255 with a grade ≥ 2.0.
This course teaches the C++ programming language. Topics include basic syntax, pointers, memory management, classes, inheritance and polymorphism, exception handling, standard template library usage, name spaces, memory management and graphical user interface (GUI) programming. Programming projects are required.

CSCD 310  Discrete Structures (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, EENG 160 with a grade ≥ 2.0, MATH 301 with a grade ≥ 2.0, advancement programming exam clearance.
This course studies mathematical aspects of computer science with emphasis on data structures and algorithmic implementation. Topics include logic, methods of proof, set theory, relations and functions, numerical representations, cardinality, computability, combinatorics, discrete probability, computational complexity and graph theory.

CSCD 316  Practical Problem Solving (2)  
Note: Repeatable up to twice.
Prerequisites: CSCD 300 with a grade ≥ 2.5.
This course explores problem solving techniques. Topics covered may include: useful strategies for the ACM programming contest, strings and their manipulation; sorting strategies; number manipulation, combinations and theory; backtracking; graph algorithms and traversals; dynamic programming and geometry; and grids. Emphasis will be on understanding algorithms and recognize which algorithm applies to a given problem. Programming projects are required.

CSCD 320  Algorithms (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, MATH 301 with a grade ≥ 2.0, advancement programming exam clearance.
This course studies data structures and algorithms, with emphasis on algorithmic strategies such as dynamic programming and emphasis on non-linear data structures such as trees and graphs. Programming projects are required.

CSCD 327  Relational Database Systems (4)  
Prerequisites: MATH 301 with a grade ≥ 2.0 or math proficiency and CSCD 211 with a grade ≥ 2.5 or CSCD 255 with a grade ≥ 2.5.
This course covers the basic concepts in relational database systems, including data manipulation language and data definition language. Relational modeling will be covered in depth together with an overview of SQL, Relational Algebra, Entity-Relationship Model and its role in application development.

CSCD 330  Computer Networks (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, advancement programming exam clearance.
This course covers fundamental concepts, protocol mechanisms and programming skills for computer networks. It includes a technical overview of telecommunication media and fundamental protocols for the Internet such as ISO/OSI layers, Ethernet, collision detection and channel allocation. Programming projects are required.

CSCD 340  Operating Systems (5)  
Prerequisites: CSCD 240 with a grade ≥ 2.5, advancement programming exam clearance.
This course covers major concepts of computer operating systems. Topics may include historical development of operating systems, system calls, resource allocation, process and thread management, basic memory management, and file systems. Programming projects are required.

CSCD 349  Design Patterns (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, advancement programming exam clearance.
This course involves program implementation of object oriented principle design patterns such as SOLID. Programming projects and group projects are required.

CSCD 350  Software Engineering (4)  
Prerequisites: CSCD 349 with a grade ≥ 2.5 and advancement programming exam clearance.
This course covers formal approaches and tools for conceiving, understanding, analyzing, designing, building, testing, deploying, documenting and maintaining large software systems. Topics may include software lifecycle models; project and team management; verification and validation techniques; legal and ethical issues; practical development and application of skills in critical-thinking, communication and professionalism. A major team-based software development project is required.

CSCD 370  Graphical User Interface Programming (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, advancement programming exam clearance.
This course explores programming techniques for the production of graphical user interfaces. Event driven programming is covered in detail. Topics include event handling, windows and dialogs, GUI widgets such as menus, toolbars, buttons, sliders, combo boxes, lists and scrolling. Multi-threading as it applies to GUI programming is also introduced. Programming projects are required.

CSCD 371  .NET Programming (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, advancement programming exam clearance.
This course introduces .NET Programming and the .NET framework. Emphasis is placed on understanding the syntactical features of the language and how to effectively use the design of the language in conjunction with the .NET framework. Topics include: C#, .NET assemblies, language fundamentals, object oriented design and programming, delegates and events, threading, serialization, database connectivity, windows and dialogs, and GUI components. Programming projects are required.

CSCD 372  Android Mobile Development (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, advancement programming exam clearance.
This course introduces Android Programming and the Android framework. Emphasis is placed on understanding the syntactical features of the language and how to effectively use the design of the language in conjunction with mobile development. Topics include event handling, windows and dialogs, and GUI components. Programming projects are required.

CSCD 373  iOS Mobile Development (4)  
Prerequisites: CSCD 300 with a grade ≥ 2.5, advancement programming exam clearance.
This course introduces iOS programming and the Apple framework. Emphasis is placed on understanding the syntactical features of the language and how to effectively use the design of the language in conjunction with mobile development. Topics include event handling, windows and dialogs, and GUI components. Programming projects are required.

CSCD 374  Software Engineering (4)  
Prerequisites: CSCD 349 with a grade ≥ 2.5 and advancement programming exam clearance.
This course covers formal approaches and tools for conceiving, understanding, analyzing, designing, building, testing, deploying, documenting and maintaining large software systems. Topics may include software lifecycle models; project and team management; verification and validation techniques; legal and ethical issues; practical development and application of skills in critical-thinking, communication and professionalism. A major team-based software development project is required.

CSCD 375  Web Application Development (4)  
Prerequisites: CSCD 327 with a grade ≥ 2.5, DESN 368 or XHTML/HTML knowledge (highly recommended) or permission of the instructor.
This course examines the fundamental principles and techniques associated with the development of multi-tier web applications. Topics include web standards, portability and usability. Programming projects are required.

CSCD 376  Sound Spaces (3)  
Cross-listed: MUSC 386.  
Prerequisites: DESN 368 or permission of the instructor.
CSCD/MUSC 386 is a project oriented course for designing, building, composing and performing with new instruments. Students will be encouraged to collaborate in the learning process, share their knowledge and experiences. The course is interdisciplinary in nature. Ideally the class would consist of students with backgrounds in music, programming and engineering.

CSCD 395  Internship (1–10)  
Note: permission of the instructor, department chair and college dean.

CSCD 396  Experimental Course (1–5)  

CSCD 397  Workshops, Short Courses, Conferences (1–5)  

CSCD 398 Seminar (2–5)
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 399 Directed Study (1–5)
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 402 Computing Ethics (4)
Prerequisite: senior standing. This course explores the uses of computing technologies from a socio-cultural perspective, including the impacts of information systems on individuals, organizations, and society and future directions in which the forces of technology and computing are tending to move us.

CSCD 409 Scientific Programming (4)
Prerequisites: MATH 161 with a grade ≥ 2.0 and MATH 231 with a grade ≥ 2.0 or MATH 361 with a grade ≥ 2.0.
This course provides an introduction to scientific computing in a programmable mathematics-oriented environment such as Matlab or Octave. Topics include programming constructs, data visualization, solutions to linear systems of equations and algebraic approaches to root-finding, signal processing, interpolation and optimization. Programming projects are required.

CSCD 411 Multimedia Techniques (4)
Prerequisites: CSCD 300 with a grade ≥ 2.5 and advancement programming exam clearance or permission of instructor.
The theory and creation of multimedia using professional software is covered. This course stresses the appropriate development of a user interface. Several programming projects and research will be required.

CSCD 414 Multimedia Programming (4)
Prerequisites: CSCD 411 with a grade ≥ 2.5 or permission of instructor.
This course studies object-oriented programming for multimedia. Students will write object-oriented programs that work with web servers and databases to create rich Internet applications. Programming projects are required.

CSCD 416 3D Modeling and Animation II (4)
Prerequisites: CSCD 216 with a grade ≥ 2.5.
This course covers intermediate 3D modeling and animation, including creation of aesthetic and technical work by manipulating light, surface materials, soft body dynamics and other features. Topics include photorealism, spline surface modeling, character development, lighting and camera and rendering. This course requires projects.

CSCD 417 3D Modeling and Animation III (4)
Prerequisite: CSCD 416 with a grade ≥ 2.5.
This course studies advanced 3D modeling, animation theory and application including creation of characters and creatures that come alive. Topics include organic modeling of character forms, analysis of character movement and 3D scripting. This course requires projects.

CSCD 418 3D Modeling and Animation IV (4)
Prerequisite: CSCD 417 with a grade ≥ 2.5.
This course studies extensions of advanced 3D modeling, animation theory and application including further advanced 3D animation concepts. Topics addressed will include lip synchronization, facial expressions and 3D scripting. This course requires 3D projects.

CSCD 420 Automata (4)
Prerequisites: MATH 301 with a grade ≥ 2.0 or MATH 225 with a grade ≥ 2.0 or permission of instructor. Some prior programming experience is recommended.
This course is a study of the algebraic, structural and logical properties of sequential machines. Projects are required.

CSCD 427 Advanced Database Management Systems (4)
Prerequisite: CSCD 300 with a grade ≥ 2.5, advancement programming exam clearance.
This course focuses on current trends in database technologies. Topics may include secondary storage, index structures, query processing, query optimization, concurrency control, transaction management, distributed databases, data mining and information management. Programming projects are required.

CSCD 428 Data Mining (4)
Prerequisite: CSCD 320 with a grade ≥ 2.5, CSCD 372 with a grade ≥ 2.5, advancement programming exam clearance.
Data mining is the process of automatic discovery of patterns, changes, associations and anomalies in massive databases. This course will provide an introduction to the main topics in data mining and knowledge discovery, including: data preparation for knowledge discovery, frequent pattern and association mining, classification and cluster analysis.

CSCD 433 Advanced Computer Networks (4)
Prerequisites: CSCD 330 with a grade ≥ 2.5, advancement programming exam clearance.
This course will cover the design, implementation, analysis and evaluation of networks. Topics include protocol mechanisms, advanced network architecture, network algorithms, network control, network simulation and performance analysis. Programming assignments are required.

CSCD 434 Network Security (4)
Prerequisites: CSCD 372 with a grade ≥ 2.5, advancement programming exam clearance.
This course explores practical topics in network security. Topics include policy and mechanism: malicious code; intrusion detection, prevention, response; cryptographic and protocols for privacy and integrity. This course emphasizes the trade-offs among risks of misuse, cost of prevention and social issues. Concepts are implemented in programming assignments and comprehensive projects.

CSCD 435 Principles of Programming Languages (4)
Prerequisites: CSCD 372 with a grade ≥ 2.5, advancement programming exam clearance.
This course is a study of comparison of programming languages by evolution, formal specifications, structures, features and application domains. Implementation of syntax and semantics and program run-time behavior for several languages will be considered. Programming projects required and presentations may be required.

CSCD 437 Secure Coding (4)
Prerequisites: CSCD 300 with a grade ≥ 2.5, CSCD 240 with a grade ≥ 2.5, advancement programming exam clearance.
This course will introduce a variety of topics of concern to programmers when writing code. It will examine concepts that apply to programming in the large as well as minor aspects such as buffer overflow. C and C++ code will be examined. Written assignments, coding assignments and a team project are required.

CSCD 439 Topics in Computer Science (2–5)
Prerequisites: applied as required by the topic.
This course is a variable topics course dealing with current trends in computer science. Possible topics include compiler design, advanced operating systems, computational complexity, computer graphics, software testing and verification, artificial intelligence, pattern recognition, computer simulation and modeling, graph algorithms.

CSCD 440 Advanced Operating Systems (4)
Prerequisite: CSCD 340 with a grade ≥ 2.5, advancement programming exam clearance.
This course covers a specific operating system involving installation, kernel configuration and kernel modification. The interaction between kernel space and user space is studied and the student designs, implements and tests programs communicating across a system interface. Programming projects are required.

CSCD 443 Distributed Multiprocessing Environments (4)
Prerequisites: CSCD 340 with a grade ≥ 2.5, advancement programming exam clearance.
This course explores parallel processing concepts and history, including the study and comparison of several multi-processing environments (such as Java threads, PVM and MPI). Programming projects will be required in the Unix environment and the C and Java languages.

CSCD 460 Advanced Architecture and Organization (4)
Prerequisites: CSCD 260 with a grade ≥ 2.5, advancement programming exam clearance.
This course addresses computer processor design at the levels of the instruction set, the architecture and logical gates. Knowledge of Boolean algebra and digital circuits are combined with a viewpoint of computers at the machine language level to build a complete understanding of how modern computer processors actually work, with some techniques and trade-offs that go into their design. The simulation of systems using a high-level programming language is also covered. Programming projects are required.

CSCD 461 Embedded Systems (4)
Prerequisites: CSCD 260 with a grade ≥ 2.5 or CSCD 255 with a grade ≥ 2.5 and EENG 260 with a grade ≥ 2.0.
This course introduces embedded systems with emphasis on software development. Topics include surveys on digital systems design, software/hardware interface, communication protocols, interrupt service routines and applications programming in an embedded controller.

CSCD 462 Embedded Real-Time Control (4)
Prerequisites: CSCD 255 with a grade ≥ 2.5 or EENG 160 with a grade ≥ 2.0, MATH 161 with a grade ≥ 2.0 and CSCD 260 with a grade ≥ 2.5.
This course covers technologies typically found in embedded control systems, including basic hardware/software interfaces, multitasking, real-time scheduling and feedback control.

CSCD 467 Parallel and Cloud Computing (4)
Prerequisites: CSCD 300 with a grade ≥ 2.5 and advancement programming exam.
This course explores up-to-date parallel platforms, such as Cluster computing and Cloud computing that use networked computers to store and process large datasets in parallel. Topics include synchronization techniques, high-performance server/service design, performance issues, distributed file systems and Map Reduce framework, virtualization and VPN technology in the Cloud, Cloud scalability and availability and Cloud storage. Hands-on assignments and projects are required.

CSCD 470 3D Computer Graphics Principles (4)
Prerequisites: CSCD 300 with a grade ≥ 2.5, MATH 231 with a grade ≥ 2.0, advancement programming exam clearance.
This course introduces the basic theoretical concepts involved in 3D computer graphics. Concepts will be illustrated using 3D rendering software allowing students to understand the practical application of the theory. Programming projects will be required.
CSCD 471 Advanced 3D Computer Graphics Programming (4)
Prerequisites: CSCD 470 with a grade ≥2.5, advancement programming exam clearance.

This course involves program implementation of 3D computer graphics theory elements from previous graphics courses using a commonly available cross-platform 3D graphics application program interface. Programming assignments include implementation of topics from previous courses such as generation of graphics primitives, the virtual camera, perspective projection, modeling and representation of three-dimensional objects and basic lighting. Additional topics include the theory and implementation of realistic object rendering using Phong and Gouraud shading techniques, texture mapping and other advanced rendering techniques such as the production of shadows and reflections and the use of advanced rendering techniques in 3D games. Programming projects are required.

CSCD 474 Computer Games Development (4)
Prerequisites: CSCD 110 with a grade ≥2.5, CSCD 316 with a grade ≥2.5.

This course is an in-depth analysis of the source code of a game leading to a major modification of the code and related elements to produce a new 3D game. Topics may include techniques for modification of game graphics, game artificial intelligence and game physics, as well as exploration of external applications for model production, animation and shading and game level production. Programming projects and game modifications are required.

CSCD 476 Advanced 3D Modeling and Animation Topics (4)
Prerequisites: CSCD 300 with a grade ≥2.5, advancement programming exam clearance.

This course involves compositing with complex animation software plug-ins. Topics include reassembling 3D animations in 2D compositing space, color depth, advanced 3D scripting and integration, 3D animations and live-action footage. Professional-level 3D projects are required.

CSCD 480 Intelligent Systems (4)
Prerequisites: CSCD 300 with a grade ≥2.5 and advancement programming exam.

Fundamental concepts and techniques of modeling, simulating, visualizing and analyzing complex real-world systems by using artificial intelligence, knowledge acquisition and representation, reasoning, planning, machine learning, expert systems, intelligent agents and multiagent architectures, and search strategies. The course emphasizes practical applications to modern smart and mobile devices.

CSCD 487 Human Computer Interface (4)
Prerequisites: CSCD 300 with a grade ≥2.5 or permission of instructor.

This course will begin with a brief historical overview of human-computer user interfaces with an eye to identifying the key steps in their conceptual development. Students will read in the field of classical human factors, focusing on findings of a particular relevance to user interface design and operation. They will explore the domain of interaction design and testing and intellectual property protection as it relates to human-computer interfaces, investigating what constitutes (or does not constitute) a patentable method and how patent protections are pursued. Written projects and team projects are required.

CSCD 488 Senior Project (5)
Note: students will receive a grade until successful completion of CSCD 490.
Prerequisites: CSCD 327 with a grade ≥2.5, CSCD 350 with a grade ≥2.5, either CSCD 378 or CSCD 379, and advancement programming exam clearance.

This course is the first of a two-quarter project sequence. Students will take CSCD 490 Senior Capstone and then complete the successful completion of Senior Project. Student teams apply computer science principles to client-sponsored projects. Based on requirements provided by the client, each team will use appropriate tools, digital systems, and management skills in support of project development.

CSCD 490 Senior Capstone (5)
Prerequisites: CSCD 488 prior quarter.
Satisfies: senior capstone university graduation requirement.

This course is the second course of a two-quarter project sequence and must be taken the quarter following successful completion of the Senior Project course. During this course the client-specific project is completed using appropriate tools and digital systems development methodologies to additionally specify, design, implement, install and test a successful outcome that meets the client’s needs. Milestone reports, including a final oral report and complete final project documentation (in printed and electronic form) are required.

CSCD 495 Internship (1–10)
Note: graded Pass/Fail.
Prerequisites: CSCD 300 with a grade ≥2.5; permission of the instructor, department chair and college dean.

CSCD 496 Experimental (1–5)

CSCD 497 Workshops, Short Courses, Conferences (1–5)

Selected topics to be arranged in consultation with the requesting organization.

CSCD 498 Seminar (1–5)
Prerequisite: permission of the instructor.

CSCD 499 Directed Study (1–5)
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 500 Colloquium in Computer Science (1)
Prerequisite: graduate standing.

This course presents a speaker-based seminar for graduate students intended as an introduction to research currently being conducted by CS faculty and graduate students with some outside perspective from other institutions and corporations. Students will gain knowledge of current faculty research, which will aid them with their own research in CS sub-disciplines and with selecting a graduate advisor.

CSCD 501 Advanced Algorithms (5)
Prerequisites: CSCD 320 and either MATH 301 or CSCD 330 or equivalent.

This course studies advanced data structures and skills for designing and analyzing nontrivial algorithms. The course will progress toward advanced topics based on the foundation of basic algorithm design methods and skills such as divide-and-conquer and dynamic programming. The course will cover topics including approximate algorithms, randomized algorithms and statistical analysis, string algorithms, algorithms for network flow problems, various advanced data structures and the NP-completeness theory.

CSCD 505 Cryptography (4)
Prerequisite: MATH 225 or MATH 301 or equivalent.

This course covers the general principles of modern cryptography, including symmetric cryptosystems, asymmetric cryptosystems, secure hash functions and cryptographic level randomness. Other topics may include historic cryptosystems and their cryptanalysis, information entropy, zero knowledge proofs, trusted computing architectures and information theory as it relates to cryptography. Programming assignments will be required. Writing and class presentations may be required.

CSCD 506 Research Methods in Computer Science (5)
Prerequisites: graduate or post baccalaureate standing.

This course explores research and research methods in the computer science discipline. Topics covered include literature review, hypothesis formation, quantitative methods, paper and thesis writing and presentation skills. Students will also be exposed to research conducted by department faculty and graduate students as well as presenters from other institutions. Students will gain knowledge of current faculty research, which will aid them in choosing their research.

CSCD 524 Advanced Software Engineering (5)
Prerequisites: CSCD 350 with a grade ≥2.5 or equivalent software development experience.

A variable content survey of fundamental and advanced topics in software engineering. The course includes the study of the evolving methods and techniques available to develop high quality, reliable and maintainable software with efficient allocation of organizational resources. Possible topics include system reliability and security, open source development, system architecture, components and system reuse. Individual research projects are required.

CSCD 527 Modern Database Systems (5)
Prerequisites: CSCD 327 or equivalent.

An in-depth study of relational DBMSs and other selected database topics. Possible topics include recovery, concurrency control, transaction management, distributed DB models and various NoSQL systems.

CSCD 533 Computer Networks (4)
Prerequisites: CSCD 330 or equivalent.

Advanced topics in computer networks is the primary focus of this course. Design and performance of networks are studied by analyzing hardware and software concepts such as routers, switches and physical connection media are covered. Protocol analysis and design is covered using existing protocol common in today’s network. Performance of networks is also studied including TCP/IP protocols, IPv6, possibly ATM or other circuit switched technologies. Programming assignments and hands-on labs will be expected.

CSCD 538 Topics in Computer Hardware (4)
Prerequisite: graduate standing in computer science or permission of the instructor.

A variable content course dealing with some aspect of computer hardware. Possible topics include network theory, computer design, control systems, digital systems design, switching and automata theory, computer-aided engineering. May be taken more than once, provided distinct topics are studied.

CSCD 539 Topics in Computer Science (4)
Prerequisite: graduate standing in computer science or permission of the instructor.

A variable content course dealing with an area of computer science other than hardware. Possible topics include computer-aided design, advanced operating systems, computational complexity, computer graphics, software testing and verification, artificial intelligence, pattern recognition, computer simulation and modeling. May be taken more than once, provided distinct topics are studied.
COMPUTER SCIENCE

CSCD 540 Advanced Operating Systems (5)  
Prerequisites: CSCD 340 or equivalent.  
The course covers synchronization in concurrent/distributed computing (which modern operating systems must support) and the implementation of virtual machine operating systems. Implementation includes file systems, memory management, paging, task switching, process management and basic operating system services. The virtual machine must be able to support various CPUs time allocations schemes to simulate multiprocessor systems of different processing speeds.

CSCD 543 Distributed Multiprocessing Environments (4)  
Prerequisites: CSCD 340 or equivalent.  
This course explores parallel processing concepts and history, including the study and comparison of several multi-processing environments (such as Java threads, PVM and MPI). Programming projects will be required in the Unix environment and the C and Java languages.

CSCD 544 Time-Critical Networking (4)  
Prerequisites: CSCD 330 or equivalent.  
This course studies multimedia networking concepts and history, including the study of current practices in multimedia networking technologies and protocols for multimedia signal transport. Selected contemporary multimedia networking application areas are studied as examples. Special emphasis is placed on challenges to multimedia signal transport involving quality of service such as signal latency and jitter. Research projects are required.

CSCD 567 Parallel and Cloud Computing (4)  
Prerequisites: CSCD 300 and Advance Programming Exam clearance or equivalent.  
This course studies the core technologies used to develop the essential components in modern distributed, parallel and Cloud systems using networked computers to store and process large datasets in parallel. Topics include synchronization techniques, high-performance server/service design, performance issues, MPI programming, distributed file systems and Map Reduce framework, Virtualization and VPN technology in Cloud, Cloud scalability and availability and data consistency in the Cloud. Graduate students are required to read research papers and implement the methodology on parallel platforms or in the Cloud.

CSCD 570 Photo-Realistic Computer Graphics (4)  
Prerequisite: CSCD 471 or equivalent.  
Theory and programming techniques of global illumination for photorealistic rendering in computer graphics. Included topics: basics of ray tracing, advanced ray tracing topics including stochastic ray tracing, incorporation of other global illumination techniques including radiosity and photon tracing. Requires programming assignments.

CSCD 575 Computer Systems Design (4)  
A survey of computer system architecture including levels of machine description, instruction sets, interrupt handling, memory hierarchies, I/O subsystems and buses.

CSCD 580 Intelligent Systems (4)  
Fundamental concepts and techniques of modeling, simulating, visualizing and analyzing complex real-world systems by using artificial intelligence, knowledge acquisition and representation, reasoning, planning, machine learning, expert systems, intelligent agents and multiagent architectures, and search strategies. The course emphasizes practical applications to modern smart and mobile devices. A research project is required.

CSCD 587 Human-Computer Interface (4)  
Prerequisite: CSCD 210 or CSCD 365.  
This course will begin with a brief overview of human-computer user interfaces historically, with an eye to identifying the key steps in their development conceptually. Students will read in the field of classical human factors, focusing on finding a particular relevance to user interface design and operation. Exploration of the domain of interaction design and testing and intellectual property protection as it relates to human-computer interfaces, investigating what constitutes (or does not constitute) a patentable method and how patent protections are pursued will be discussed. Written projects and team projects are required.

CSCD 595 Professional Internship (2–16)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 596 Experimental Course (2–5)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 597 Workshops (1–5)  
Note: only one workshop course for up to 3 credits may be used to fulfill graduate degree requirements.

CSCD 598 Seminar (1–5)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 599 Independent Study (1–6)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 600 Thesis (2–16)  
Note: graded Pass/No Credit.  
Prerequisite: permission of the instructor, department chair and college dean.  
A research thesis under the direction of a graduate committee.

CSCD 601 Research Report (2–16)  
Note: graded Pass/No Credit.  
Prerequisite: permission of the instructor, department chair and college dean.  
A research study in lieu of a bound thesis conducted as partial fulfillment of a master’s degree under the direction of a graduate committee.

CSCD 602 Industry Project (2–4)  
Note: graded Pass/No Credit.  
Development and documentation of applied computer science project in an industry setting.

CSCD 605 Departmental Internship (2–12)  
Note: graded Pass/No Credit.  
Prerequisite: graduate standing; permission of the instructor, department chair and college dean.  
Support work for the department relating to computer science. Activities will take place under the supervision of a department faculty or staff member. May involve experiences such as teaching lower-division coursework, systems administration activities and assisting with research activities.

Note: only one workshop course for up to 3 credits may be used to fulfill graduate degree requirements.

CSCD 695 Professional Internship (2–16)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 696 Departmental Internship (2–12)  
Note: graded Pass/No Credit.  
Prerequisite: graduate standing; permission of the instructor, department chair and college dean.  
Support work for the department relating to computer science. Activities will take place under the supervision of a department faculty or staff member. May involve experiences such as teaching lower-division coursework, systems administration activities and assisting with research activities.

CSCD 697 Workshops (1–5)  
Note: only one workshop course for up to 3 credits may be used to fulfill graduate degree requirements.

CSCD 698 Seminar (1–5)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 699 Independent Study (1–6)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 700 Thesis (2–16)  
Note: graded Pass/No Credit.  
Prerequisite: permission of the instructor, department chair and college dean.  
A research thesis under the direction of a graduate committee.

CSCD 701 Research Report (2–16)  
Note: graded Pass/No Credit.  
Prerequisite: permission of the instructor, department chair and college dean.  
A research study in lieu of a bound thesis conducted as partial fulfillment of a master’s degree under the direction of a graduate committee.

CSCD 702 Industry Project (2–4)  
Note: graded Pass/No Credit.  
Development and documentation of applied computer science project in an industry setting.

CSCD 705 Departmental Internship (2–12)  
Note: graded Pass/No Credit.  
Prerequisite: graduate standing; permission of the instructor, department chair and college dean.  
Support work for the department relating to computer science. Activities will take place under the supervision of a department faculty or staff member. May involve experiences such as teaching lower-division coursework, systems administration activities and assisting with research activities.

Note: only one workshop course for up to 3 credits may be used to fulfill graduate degree requirements.

CSCD 795 Professional Internship (2–16)  
Prerequisite: permission of the instructor, department chair and college dean.

CSCD 796 Departmental Internship (2–12)  
Note: graded Pass/No Credit.  
Prerequisite: graduate standing; permission of the instructor, department chair and college dean.  
Support work for the department relating to computer science. Activities will take place under the supervision of a department faculty or staff member. May involve experiences such as teaching lower-division coursework, systems administration activities and assisting with research activities.

Note: only one workshop course for up to 3 credits may be used to fulfill graduate degree requirements.

CSCD 800 Thesis (2–16)  
Note: graded Pass/No Credit.  
Prerequisite: permission of the instructor, department chair and college dean.  
A research thesis under the direction of a graduate committee.

CSCD 801 Research Report (2–16)  
Note: graded Pass/No Credit.  
Prerequisite: permission of the instructor, department chair and college dean.  
A research study in lieu of a bound thesis conducted as partial fulfillment of a master’s degree under the direction of a graduate committee.

CSCD 802 Industry Project (2–4)  
Note: graded Pass/No Credit.  
Development and documentation of applied computer science project in an industry setting.

CREATIVE WRITING  
See ENGLISH Undergraduate Programs