

COMPUTER SCIENCE

College of Science, Health & Engineering • School of Computing & Engineering Sciences

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BA	BS	Minors
		MS

Faculty:

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UNDERGRADUATE PROGRAMS

Computer Science is a rapidly evolving and exciting 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.

Research Facilities and Equipment

The Animation Production Studio: Equipped with professional grade software and hardware, this lab houses our motion capture system and blue screen 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 state of the art 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 Lab: This lab supports studies of computer architecture and embedded systems programming.

Parallel Processors: The department has a Beowulf cluster and an array processor that support coursework and projects in parallel and distributed computing.

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: Designed to support junior and senior level Computer Science and Computer Information Systems courses, this lab is equipped with powerful Unix/Linux/Windows workstations and servers made available for course projects in software design; client/server application development; relational database design and administration; and signal processing.

Opportunities for Students: Upper-division majors may check with the department operations manager concerning the possibility of applying for work-study and departmental positions as course assistants, paper graders, tutors, or computer consultants.

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 students 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.

Preparation: High school students wanting to pursue a major in this department are advised to take as much mathematics as possible, including a course or courses in their senior year. Students will benefit from computer science courses available in their high school but should not take them at the expense of mathematics courses. High school students are also 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, dependent upon the degree of choice, as well as an advanced sophomore level composition course. Washington and North Idaho students can consult transfer guides at WWW.EWU.EDU/TRANSFERGUIDE to determine which courses are equivalent for general education requirements and courses that may apply to the major. All transfer students are encouraged to contact the department for advice on selecting their preparatory coursework. Courses taken to apply to the major should be taken late in the 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. The prospective student is asked to bring official or unofficial copies of all college-level work and schedule an advising session. At that advising session the student will have the opportunity to review course requirements, ask questions, prepare a quarterly schedule and declare the major. Declaring a major requires agreeing to abide by the department's *Code of Ethics and Professional Conduct*, which is available on the department's website, WWW.EWU.EDU/COMPSCI.

Grade Requirements: A student must maintain a 2.5 overall university GPA. Each computer science course must be completed with a minimum 2.5 grade. All supporting courses required by the department must be completed with a minimum 2.0 grade.

BACHELOR OF ARTS (BA)

STUDENT LEARNING OUTCOMES for the BA in Computer Science, Game Development/Animation Option may be found at www.ewu.edu/CSSLO

GAME DEVELOPMENT/ANIMATION OPTION (95 –97 CREDITS)

The Game Development/Animation Option focuses on the use of typical tools for developing computer games and animations. Like all of our degrees, it builds on substantial core material in general-purpose programming. Careers in the game development and animation industries are highly competitive. Job seekers in these industries should have a strong work ethic and may require artistic/story-telling skills beyond what the degree requires.

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

Required Computer Science Courses

- CSCD 210 Programming Principles I (5)
- CSCD 211 Programming Principles II (5)
- CSCD 240 C and Unix Programming (4)
- CSCD 300 Data Structures (4)
- CSCD 320 Algorithms (4)
- CSCD 327 Relational Database Systems (4)
- CSCD 330 Computer Networks (4)
- CSCD 350 Software Engineering (4)
- CSCD 370 Graphical User Interface Programming (4)
- CSCD 488 Senior Project (5)
- CSCD 490 Senior Capstone (5)

Pick one of the following groups of classes:

Group A:

- CSCD 216 3D Modeling and Animation I (4)
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 471 Advanced 3D Computer Graphics Programming (4)
- CSCD 474 Computer Games Development (4)
- MATH 231 Linear Algebra (5)

Group B:

- 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 Computer Graphics (4)

Required Supporting Courses

Mathematics	MATH 301 Discrete Mathematics (5)
Philosophy	PHIL 212 Introduction to Ethics (5)

Elective Courses: four additional elective courses.

- CSCD 303 Computer and Information Security (4)
- CSCD 305 C++ Programming (4)
- CSCD 306 .NET Programming (4)
- CSCD 340 Operating Systems
- CSCD 378 Web Application Development (4)
- CSCD 379 .NET Web Application Development (4)
- CSCD 409 Scientific Programming (4)
- CSCD 418 3D Modeling and Animation IV (4)
- CSCD 420 Automata (4)
- CSCD 427 Advanced Database 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)¹
- CSCD 461 Embedded Systems (4)
- CSCD 487 Human Computer Interface (4)
- CSCD 495 Internship (two 4–5 credit internships are allowed)
- CSCD 396, 398, 399, 3xx, 439, 496, 498, 499, 4xx (4–5) prior departmental approval of topic content is required.

Note: any Group A or Group B course not used as a requirement can be used as an elective.

Note: many of these elective courses have pre-requisites.

Total required computer science credits	48 credits
Required group A or B	21 credits
Required math credits	5 credits
Required philosophy credits	5 credits
Required elective credits	16–18 credits
Minimum total required credits for above major	95 credits
<i>¹CSCD 460 requires a prerequisite of CSCD 260.</i>	

Note: Students are encouraged to choose CMST 340 Intercultural Communications or CMST 414 Gender and Communications to fulfill their cultural and gender diversity requirement and/or CMST 440 International Communications to fulfill their international studies requirement.

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 (94–96 CREDITS)

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.

Required Computer Science Courses

- CSCD 210 Programming Principles I (5)
- CSCD 211 Programming Principles II (5)
- CSCD 240 C and Unix Programming (4)
- CSCD 300 Data Structures (4)
- CSCD 320 Algorithms (4)
- CSCD 327 Relational Database Systems (4)
- CSCD 330 Computer Networks (4)
- CSCD 350 Software Engineering (4)
- CSCD 370 Graphical User Interface Programming (4)
- CSCD 488 Senior Project (5)
- CSCD 490 Senior Capstone (5)

Required Option Courses:

Additional electives: 20 hours of department approved coursework outside computer science.

Required Supporting Courses

Mathematics	MATH 301 Discrete Mathematics (5)
Philosophy	PHIL 212 Introduction to Ethics (5)

Electives: four additional elective courses.

- CSCD 303 Computer and Information Security (4)
- CSCD 305 C++ Programming (4)
- CSCD 306 .NET Programming (4)
- CSCD 340 Operating Systems
- CSCD 378 Web Application Development (4)
- CSCD 379 .NET Web Application Development (4)
- CSCD 409 Scientific Programming (4)
- CSCD 416 3D Modeling and Animation II (4)¹
- CSCD 417 3D Modeling and Animation III (4)
- CSCD 418 3D Modeling and Animation IV (4)
- CSCD 420 Automata (4)
- CSCD 427 Advanced Database 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)²
- CSCD 461 Embedded Systems (4)
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 471 Advanced 3D Computer Graphics Programming (4)
- CSCD 474 Computer Games Development (4)
- CSCD 487 Human Computer Interface (4)
- CSCD 495 Internship (two 4–5 credit internships are allowed)
- CSCD 396, 398, 399, 3xx, 439, 496, 498, 499, 4xx (4–5) prior departmental approval of topic content is required.

Required computer science credits	48 credits
Required option credits:	20 credits
Required math credits	5 credits
Required philosophy credits	5 credits
Required elective credits	16–18 credits
Minimum total required credits for above major	94 credits
<i>¹CSCD 216 required prerequisite for CSCD 416</i>	
<i>²CSCD 260 required prerequisite for CSCD 460</i>	

Note: Students are encouraged to choose CMST 340 Intercultural Communications or CMST 414 Gender and Communications to fulfill their cultural and gender diversity requirement and/or CMST 440 International Communications to fulfill their international studies requirement.

BACHELOR OF SCIENCE (BS)

STUDENT LEARNING OUTCOMES for the BS5 in Computer Information Systems may be found at www.ewu.edu/CSSLO

COMPUTER INFORMATION SYSTEMS MAJOR (104 –110 CREDITS)

Our Computer Information Systems 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 210 Programming Principles I (5)
- CSCD 211 Programming Principles II (5)
- CSCD 240 C and Unix Programming (4)
- CSCD 300 Data Structures (4)
- CSCD 320 Algorithms (4)
- CSCD 327 Relational Database Systems (4)
- CSCD 330 Computer Networks (4)
- CSCD 340 Operating Systems (4)
- CSCD 350 Software Engineering (4)
- CSCD 370 Graphical User Interface Programming (4)
- CSCD 488 Senior Project (5)
- CSCD 490 Senior Capstone (5)

Choose either CSCD 378 or CSCD 379

- CSCD 378 Web Application Development (4)
- CSCD 379 .NET Web Application Development (4)

Choose either CSCD 427 or CSCD 429

- CSCD 427 Advanced Database Systems (4)
- CSCD 429 Data Mining (4)

Required Supporting Courses

Mathematics	MATH 301 Discrete Mathematics (5) MATH 380 Elementary Probability and Statistics (5) or both DSCI 245 Data Analysis for Business (4) and DSCI 346 Advanced Data Analysis for Business (4)
Philosophy	PHIL 212 Introduction to Ethics (5)

Select one of the following areas of interest

Biochemistry

(students should choose CHEM 151 and CHEM 152 for their Natural General Education Requirement)

- CHEM 153 General Chemistry III (5)
- CHEM 351 Organic Chemistry I (4)
- CHEM 352 Organic Chemistry II (4)
- CHEM 353 Organic Chemistry III (3)
- CHEM 480 Biochemistry (5)

Biology/Genetics

(students should choose BIOL 171, BIOL 172 and BIOL 270 for their Natural Science General Education Requirement)

- BIOL 173 Biology III (4)
- BIOL 310 Fundamentals of Genetics (5)
- CHEM 151 General Chemistry I (5)
- CHEM 152 General Chemistry II (5)
- CHEM 153 General Chemistry III (5)

Business and Economics

- ACCT 251 Principles of Financial Accounting (5)
- ACCT 252 Managerial Accounting (4)
- ECON 200 Introduction to Microeconomics (5)
or ECON 201 Introduction to Macroeconomics (5)
- FINC 335 Financial Management (4)
- OPSM 330 Operations Management (4)

Note: ECON 200 and ECON 201 together count as one GEGR.

Design

- DESN 216 Computer Graphics (4)
- DESN 263 Visual Communications Design I (5)
- DESN 363 Visual Communications Design II (5)
- DESN 368 Web Design (4)
- DESN 378 Interactive Design (4)

Geographic Information Systems

- GEOG 323 GIS for Environmental Sciences (3)
- GEOG 328 Geographic Information Systems I (5)
- GEOG 427 Desktop Mapping (3)
- GEOG 428 Geographic Information Systems II (5)
- GEOG 429 Geographic Information Systems III (5)
- GEOG 493 Geographic Information Systems Portfolio (2)

Health Services Administration

- HSAD 300 Health Care Organization and Administration (4)
- HSAD 310 Health Care Supervision (4)
- HSAD 322 Health Care Technology (4)
- HSAD 410 Health Law, Regulation and Ethics (4)
- HSAD 440 Health Care Research Design and Methods (4)
- HSAD 455 Health Care Billing (2)

Elective Courses: two additional electives:

- CSCD 303 Computer and Information Security (4)
- CSCD 305 C++ Programming (4)
- CSCD 306 .NET Programming (4)
- CSCD 378 Web Application Development (4) (if not used as a requirement).
- CSCD 379 .NET Web Application Development (4) (if not used as a requirement).
- CSCD 409 Scientific Programming (4)
- CSCD 416 3D Modeling and Animation II (4)¹
- CSCD 417 3D Modeling and Animation III (4)
- CSCD 418 3D Modeling and Animation IV (4)
- CSCD 420 Automata (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 461 Embedded Systems (4)
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 471 Advanced 3D Computer Graphics Programming (4)
- CSCD 474 Computer Games Development (4)
- CSCD 487 Human Computer Interface (4)
- CSCD 495 Internship (two 4–5 credit internships are allowed)
- CSCD 396, 398, 399, 3xx, 439, 496, 498, 499, 4xx (4–5) prior departmental approval of topic content is required.

Required computer science	60 credits
Required mathematics credits	10–13 credits
Required philosophy credits	5 credits
Required environment credits	21–24 credits
*Business and Economic	22 credits
*Geographic Information Systems	23 credits
*Health Services Administration	22 credits
*Biochemistry	21 credits
*Biology/Genetics	24 credits
*Design	22 credits
Required elective credits:	8–10 credits
Minimum total required credits for above major:	104 credits
<i>1CSCD 216 required prerequisite for CSCD 416</i>	

Note: Students are encouraged to choose CMST 340 Intercultural Communications or CMST 414 Gender and Communications to fulfill their cultural and gender diversity requirement and/or CMST 440 International Communications to fulfill their international studies requirement.

BACHELOR OF SCIENCE (BS)

STUDENT LEARNING OUTCOMES *for the BS in Computer Science may be found at* WWW.EWU.EDU/CSSLO

COMPUTER SCIENCE MAJOR (129–131 CREDITS)

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 210 Programming Principles I (5)
- CSCD 211 Programming Principles II (5)
- CSCD 240 C and Unix Programming (4)
- CSCD 260 Architecture and Organization (4)
- CSCD 300 Data Structures (4)
- CSCD 320 Algorithms (4)
- CSCD 327 Relational Database Systems (4)
- CSCD 330 Computer Networks (4)
- CSCD 340 Operating Systems (4)
- CSCD 350 Software Engineering (4)
- CSCD 370 Graphical User Interface Programming (4)
- CSCD 488 Senior Project (5)
- CSCD 490 Senior Capstone (5)

Advanced Coursework—select three from the following list of courses

- CSCD 409 Scientific Programming (4)
- CSCD 420 Automata (4)
- CSCD 427 Advanced Database Systems (4)
- CSCD 429 Data Mining (4)
- CSCD 433 Advanced Computer Networks (4)
- CSCD 434 Network Security (4)
- CSCD 440 Advanced Operating Systems (4)
- CSCD 443 Distributed Multiprocessing Environments (4)
- CSCD 460 Advanced Architecture and Organization (4)¹
- CSCD 461 Embedded Systems (4)
- CSCD 470 3D Computer Graphics Principles (4)
- CSCD 471 Advanced 3D Computer Graphics Programming (4)²

Required Supporting Courses

Engineering & Design	ENGR 160 Digital Circuits (4)
Mathematics	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)
Philosophy	PHIL 212 Introduction to Ethics (5)

Required Laboratory Science Courses, choose one of the following sequence:

Biology	BIOL 171 Biology I (4) BIOL 172 Biology II (4) BIOL 270 Biological Investigation (3)
Chemistry	CHEM 151 General Chemistry I (5) CHEM 152 General Chemistry II (5)
Geology	GEOLOG 120 Physical Geology—The Solid Earth (5) GEOLOG 121 Physical Geology—Surficial Processes (5)
Physics	PHYS 151 General Physics I (4) PHYS 152 General Physics II (4) And two of the following: 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.

Elective Courses

Three additional elective courses. Select at least one course from Group A and at least one course from Group B.

Group A

- CSCD 303 Computer and Information Security (4)
 - CSCD 305 C++ Programming (4)
 - CSCD 306 .NET Programming (4)
 - CSCD 378 Web Application Development (4)
 - CSCD 379 .NET Web Application Development (4)
 - CSCD 416 3D Modeling and Animation II (4)³
 - 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 474 Computer Games Development (4)
 - CSCD 487 Human Computer Interface (4)
 - CSCD 495 Internship (two 4–5 credit internships are allowed)
- Any course from the advanced coursework list not used to satisfy the advanced coursework requirement.
- CSCD 396, 398, 399, 3xx, 439, 496, 498, 499, 4xx (4–5) prior departmental approval of topic content is required.

Group B

Must choose at least one course from the following list:

- BIOL 173 Biology III (4)
 - CHEM 153 General Chemistry III (5)
 - GEOLOG 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)
- and one of the following not previously taken:
- PHYS 161 Mechanics Laboratory (1)
 - PHYS 162 Heat and Optics Laboratory (1)
 - PHYS 163 Instrumentation Lab I (1)
 - PHYS 164 Instrumentation Lab II (1)
- Other course with prior approval of the department required.

Required computer science credits	56 credits
Required advanced computer science credits	12 credits
Required engineering credits	4 credits
Required mathematics credits	25 credits
Required philosophy credits	5 credits
Required lab science credits	15–16 credits
Required computer science electives	4–5 credits
Required math/science electives	4–5 credits
Additional required electives from group A or B	4–5 credits
Minimum total required credits for above major	129 credits

¹CSCD 470 required prerequisite for CSCD 471

²CSCD 216 required prerequisite for CSCD 416

Note: students are encouraged to choose CMST 340 *Intercultural Communications* or CMST 414 *Gender and Communications* to fulfill their cultural and gender diversity requirement and/or CMST 440 *International Communications* to fulfill their international studies requirement.

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 at least a 2.5 in each required computer science course and at least a 2.0 in each supporting course in the minors.

3D ANIMATION MINOR (16 CREDITS)

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 (16 credits)

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 Computer Graphics (4)

Minimum total credits for above minor **16 credits**

COMPUTER APPLICATIONS MINOR (28-30 CREDITS)

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 Publishing for Print and the World Wide Web (4)
 DESN 368 Web Design (4)
 MISC 311 Information Technology in Business (4)
 MISC 374 Spreadsheet Modeling for Business Applications (4)
 TECH 317 Computer Aided Drafting (4)
 Additional 3-5 credit upper division courses approved by the advisor for this minor

Minimum total credits for above minor **28 credits**

COMPUTER INFORMATION SYSTEMS MINOR (22 CREDITS)

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 (18 credits)

CSCD 210 Programming Principles I (5)
 CSCD 211 Programming Principles II (5)
 CSCD 300 Data Structures (4)
 CSCD 327 Relational Database Systems (4)

Elective: choose one of the following (4 credits)

CSCD 427 Advanced Database Systems (4)
 CSCD 429 Data Mining (4)

Minimum total credits required for above minor: **22 credits**

COMPUTER SCIENCE PROGRAMMING MINOR (26-28 CREDITS)

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

Required Courses (18 credits)

CSCD 210 Programming Principles I (5)
 CSCD 211 Programming Principles II (5)
 CSCD 240 C and UNIX Programming (4)
 CSCD 300 Data Structures (4)

Electives (8-10 credits)

Select 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 **26 credits**

GAME DEVELOPMENT MINOR (26 CREDITS)

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

Required Courses (26 credits)

CSCD 210 Programming Principles I (5)
 CSCD 211 Programming Principles II (5)
 CSCD 216 3D Modeling and Animation I (4)
 CSCD 240 C and UNIX Programming (4)
 CSCD 300 Data Structures (4)
 CSCD 474 Computer Games Development (4)

Minimum total credits required for above minor **26 credits**

WEB APPLICATION DEVELOPMENT MINOR (26-31 CREDITS)

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 Computer Graphics (4)
 DESN 368 Web Design (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**



GRADUATE PROGRAMS

MASTER OF SCIENCE IN COMPUTER SCIENCE

Carol Taylor, Program Advisor	315 CEB	509.359.6908 CTAYLOR@EWU.EDU
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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 provides a balance between practical applications-oriented content and a theoretical framework for continued learning. There is flexibility in choice of electives that allows students to emphasize areas of particular interest.

Admission Requirements/Preparation

The petitioner must (a) complete the Computer Science departmental questionnaire, (b) meet all Eastern Washington University requirements for admission to graduate study, (c) supply transcripts showing the entrance courses below or their equivalent, (d) provide a statement of purpose and self-evaluation of the potential for completion, (e) two letters of recommendation, at least one from a computer science instructor or equivalent* and (f) International students must provide a TOEFL score of 580 or greater (237 CBT, 92 iBT).

Individuals not having completed the entrance requirements may petition for probationary admission.

*The letters of recommendation will be waived for students receiving a bachelor's degree from this department.

General Entrance Requirements

- Fundamental programming courses—10 quarter hours (see CSCD 210 and 211)
- C programming and the Unix operating system—4 quarter hours (see CSCD 240)
- Data structures and algorithms—8 quarter hours (see CSCD 300 and 320)
- Operating systems—4 quarter hours (see CSCD 340)
- Discrete math (see MATH 225 or 301)
- Team software development experience (see CSCD 350)

Note: elective graduate courses often have prerequisites beyond the above requirements, and the student is responsible for mastering that material before taking such courses. If the prerequisite course is not at the senior level, it cannot be counted towards the graduate degree.

Core Requirements (24 credits)

- CSCD 500 Colloquium in Computer Science (1)
Must be taken twice, once in the first year of the program.
- CSCD 501 Design and Analysis of Algorithms (4)
- CSCD 524 Software Engineering (4)
- CSCD 540 Advanced Topics in Modern Operating Systems (4)
- CSCD 555 Research Methods in Computer Science (2)
Must be taken in the first year of the program
- CSCD 600 or CSCD 601 (8)

Electives (24 credits)

Elective courses: Any 400-level or any non Computer Science course must be approved by the Department of Computer Science graduate advisor. CSCD 695 credits cannot be used to satisfy any portion of these elective requirements.

Note: 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.

Required core credits	24 credits
Elective credits	24 credits
Total credits for above master's degree	48 credits

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.

Computer Literacy Courses

Terms offered: fall, winter, spring, summer (FWSU). 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)
Graded Pass/No Credit. Does not count toward the 180 credit requirement. Passing this course gives clearance of Computer Literacy Part I.

[satisfies the 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)
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 the 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)
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)

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.

Computer Science Courses

Terms offered: fall, winter, spring, summer (FWSU). If no terms are indicated check with the department or EagleNET.
Course fees will be required on many CSCD courses.

CSCD 110 Introduction to Programming (5)
Prerequisites: concurrent enrollment in CPLA 100 or 120 or concurrent completion of the CPLA 1 test is highly recommended.

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, compiling, 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: 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 minimum of 2.5

This course continues coverage of concepts introduced in Programming Principles I. Topics include basic sorting and searching, 2D arrays, recursion, data abstraction, polymorphism, inheritance, interfaces, inner classes, abstract classes, object cloning, file I/O, basic GUI design, exception handling and threads. Programming projects are required.

CSCD 216 3D Modeling and Animation I (4)
Prerequisites: concurrent enrollment in CPLA 100 or 120 or concurrent completion of the CPLA 1 test is highly recommended.

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 (4)
Prerequisites: CSCD 211 with a minimum grade of 2.5 or CSCD 255 with a minimum grade of 2.5.

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 105 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 minimum grade of 2.5, ENGR 160 with a minimum grade of 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 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)
Prerequisite: permission of the instructor, department chair and college dean.

Subjects studied vary according to student and faculty interest.

CSCD 300 Data Structures (4)
Prerequisites: CSCD 211 with a minimum grade of 2.5, MATH 105 or MATH 115 with a minimum grade of 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 heaps. 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, email 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)
Prerequisite: CSCD 240 with a minimum grade of 2.5 or CSCD 255 with a minimum grade of 2.5.

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 306 .NET Programming (4)
Prerequisite: CSCD 300 with a minimum grade of 2.5.

This course introduces .NET Programming and the .NET framework. Emphasis will be placed on understanding the syntactical features of the language, as well as how to effectively use the design of the language in conjunction with the .NET Framework. Topics include .NET fundamentals, .NET assemblies, language fundamentals, object-oriented design and programming, delegates and events, threading, serialization and database connectivity. Programming projects are required.

CSCD 310 Discrete Structures (4)
Prerequisites: CSCD 300 with a minimum grade of 2.5, ENGR 160 with a minimum grade of 2.0, MATH 301 with a minimum grade of 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 Contest Problems (1-5)
Prerequisite: CSCD 211 or concurrent enrollment.

Students participate in solving problems with computer programming. This is preparation for periodic local and regional programming contests.

CSCD 320 Algorithms (4)
Prerequisites: CSCD 300 with a minimum grade of 2.5, MATH 301 with a minimum grade of 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: CSCD 211 with a minimum grade of 2.5.

This course covers fundamental concepts associated with the design, implementation and use of database systems with particular emphasis on relational database management systems. Topics include data modeling and design techniques, languages and facilities provided by database management systems. Students use a state-of-the-art DBMS to design, load, query, maintain and administer a relational database. Individual projects are required.

CSCD 330 Computer Networks (4)
Prerequisites: CSCD 300 with a minimum grade of 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 (4)
Prerequisites: CSCD 240 with a minimum grade of 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 350 Software Engineering (4)
Prerequisites: CSCD 300 with a minimum grade of 2.5 and advancement programming exam clearance.

This course covers software engineering paradigms, principles and techniques. Topics include software life cycle models, requirements specification, classical and object-oriented analysis and design, verification and validation, reuse, tools, metrics and project management. Team and individual programming projects, oral presentations and written reports are required.

CSCD 370 Graphical User Interface Programming (4)
Prerequisites: CSCD 300 with a minimum grade of 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 378 Web Application Development (4)
Prerequisites: CSCD 327 with a minimum grade of 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 379 .NET Web Application Development (4)
Prerequisites: CSCD 327 with a minimum grade of 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, using the .NET Framework. Topics include web standards, portability and usability. Programming projects are required.

CSCD 386 Sound Spaces (3)

Prerequisite: DESN 385

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 and 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. (Cross-listed MUSC 386)

CSCD 395 Internship (1-10)

Prerequisite: 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)

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 200 or MATH 231 or MATH 301.

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 minimum grade of 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 minimum grade of 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 minimum grade of 2.5 [Previous or concurrent registration in DESN 216 is highly recommended.]

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 techniques. This course requires projects.

CSCD 417 3D Modeling and Animation III (4)

Prerequisite: CSCD 416 with a minimum grade of 2.5, DESN 216 with a minimum grade of 2.0.

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 minimum grade of 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 minimum grade of 2.0 or MATH 225 with a minimum grade of 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 Systems (4)

Prerequisite: CSCD 327 with a minimum grade of 2.5, advancement programming exam clearance.

This course focuses on current trends in database technologies. Topics may include data distribution, replication, query processing, database reliability and recovery, and transaction management. Individual and/or team projects, oral presentations and written reports are required.

CSCD 429 Data Mining (4)

Prerequisite: CSCD 327 with a minimum grade of 2.5 and [MATH 380 with a minimum grade of 2.0 or both DSCI 245 with a minimum grade of 2.0 and DSCI 346 with a minimum grade of 2.0], advancement programming exam clearance or permission of instructor.

This course introduces fundamental concepts, principles, and strategies for extracting knowledge from data. Students will use a variety of open source and proprietary data mining tools to develop understanding of the practical application of fundamental strategies and techniques. Programming projects involving the application of relational DBMS tools to case study datasets will be required.

CSCD 433 Advanced Computer Networks (4)

Prerequisites: CSCD 330 with a minimum grade of 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 330 with a minimum grade of 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 300 with a minimum grade of 2.5, advancement programming exam clearance.

This course is a study and 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 minimum grade of 2.5, CSCD 240 with a minimum grade of 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 specific 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 minimum grade of 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 that programming interface. Programming projects are required.

CSCD 443 Distributed Multiprocessing Environments (4)

Prerequisites: CSCD 340 with a minimum grade of 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 minimum grade of 2.5, advancement programming exam clearance.

This course addresses computer processor design at the levels of the instruction set, the system 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 240 with a minimum grade of 2.5 or CSCD 255 with a minimum grade of 2.5, CSCD 260 with a minimum grade of 2.5 or ENGR 260 with a minimum grade of 2.5.

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 467 Concurrent Systems (4)

Prerequisites: CSCD 260 and CSCD 300 with a minimum grade of 2.5 and advancement programming exam.

This course introduces concurrent systems. Topics include latent problems in concurrent computing, deadlock, starvation and process synchronization. The course emphasizes system simulation techniques. Projects are required.

CSCD 470 3D Computer Graphics Principles (4)

Prerequisites: CSCD 300 with a minimum grade of 2.5, MATH 301 with a minimum grade of 2.0, advancement programming exam clearance [CSCD 216 highly recommended].

This course introduces the basic theoretical concepts involved in 3D computer graphics. Concepts will be illustrated using 3D animation and modeling 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 minimum grade of 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 300 with a minimum grade of 2.5, advancement programming exam clearance.

This course is an in-depth analysis of the source code of a commercial 3D 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 skinning and game level production. Programming projects and game modifications are required.

CSCD 476 Advanced 3D Modeling and Animation Topics (4)

Prerequisite: CSCD 110 with a minimum grade of 2.5, CSCD 416 with minimum grade of 2.5.

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 487 Human Computer Interface (4)

Prerequisites: CSCD 300 with a minimum grade of 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)

Prerequisites: CSCD 327 with a minimum grade of 2.5, CSCD 350 with a minimum grade of 2.5, advancement programming exam clearance.

This course is the first of a two-quarter project sequence. Students will take CSCD 490 Senior Capstone the quarter following 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 with a minimum grade of 2.5, advancement programming exam clearance.

[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-specified project is completed using appropriate tools and digital systems development methodologies to additionally specify, design, implement, install and test a systems solution 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)

Prerequisites: CSCD 300 with minimum 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 conducted by CS faculty and graduate students with some outside presenters 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 Design and Analysis of Algorithms (4)

Prerequisites: CSCD 320 and MATH 301 or CSCD 310 or equivalent.

The study of algorithms: asymptotic analysis of computing time and space requirements. Strategies for designing algorithms: divide-and-conquer, greedy method, backtracking and others. Analysis of graph algorithms. Introduction to parallel algorithms and their analysis. Further topics may be covered, as time permits, such as techniques for algebraic manipulations, lower bound theory and NP-complete problems.

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 524 Software Engineering (4)

Prerequisites: CSCD 350 or equivalent software development experience.

A variable-content course. A study of methods and techniques available to develop reliable and maintainable software at minimal cost and selected software development topics. Possible topics include software metrics, object-oriented design, rapid prototyping, graphical user interface design and CASE tools. Individual research projects are required.

CSCD 525 Advanced Database Management Systems (4)

A variable-content course. An in-depth study of a commercial relational DBMS and selected database systems topics. Possible topics include data access patterns, data mining, distributed databases, multimedia databases, query optimization, object-oriented DBMS, knowledge-based systems, design and programming of 2 and 3 Tier Applications using web services and XML. Individual research projects are required.

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 in depth. Some hardware concepts such as routers, switches and physical connection media are covered. Protocol analysis and design is covered using existing protocol common in today's networks. 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, VLSI 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 compiler design, advanced operating systems, computational complexity, computer graphics, software testing and verification, artificial intelligence, pattern recognition, computer simulation and modeling, graph algorithms. May be taken more than once, provided distinct topics are studied.

CSCD 540 Advanced Topics in Modern Operating Systems (4)

Prerequisites: CSCD 340 or equivalent.

The study of advanced topics from modern operating systems. Topics may include but are not limited to device drivers, embedded operating systems, real-time operating systems, modern operating system security designs and mechanism and performance measurement and evaluation.

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 555 Research Methods in Computer Science (2)

Prerequisite: graduate standing

This course covers current research methods used in the computer science discipline. Topics covered include literature review, hypothesis formation, quantitative methods, paper and thesis writing and presentation skills. Other topics that may be included are research-related grant writing and professional service organizations. Writing assignments will be required. Class presentations may be required.

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 Brain, Cognition and Computing (4)

Prerequisites: complete admission to MSCS.

Students in this course will explore current topics in computational intelligence, intelligent informatics and computational aspects of brain and cognitive sciences. Fundamental topics to be discussed include, but are not limited to, search, logic, uncertainty, learning, human-computer interaction, language, brain and cognition. Popular applications such as game playing, expert systems, agents, robotics and information management are also discussed. Students are required to conduct extensive surveys and may be required to develop a well-specified research proposal.

CSCD 581 Computational Intelligence (4)

Prerequisites: complete admission to MSCS.

Students in this course will explore current topics in computational intelligence, with an emphasis on approaches that go beyond classic artificial intelligence. Topics are typically selected from current activities in reputable academic societies and include, but are not limited to, fuzzy logic, neural networks, evolutionary computing, swarm intelligence, cybernetics, soft computing, symbiotic computing, computational theory of perception, granular computing, brain and cognitive computing, image and vision understanding, uncertainty management, computational logic and computational linguistics. Students are required to generate research results as specified in proposals and are expected to report their progress and insightful thought in the research practicum.

CSCD 582 Intelligent Informatics (4)

Prerequisites: complete admission to MSCS.

Students in this course will explore current topics on the use of computational intelligence in informatics. Topics are typically selected from current activities in reputable academic societies and include, but are not limited to, intelligent data analysis, risk analysis, decision support, knowledge management, information exploitation, bioinformatics, cheminformatics, business informatics, ecoinformatics, education informatics, health informatics, laboratory informatics, neuroinformatics, geoinformatics, knowledge-based engineering and security informatics. Students are required to generate research results as specified in proposals and are expected to report their progress and insightful thought in the research practicum.

CSCD 587 Human-Computer Interface (4)

Prerequisite: CSCD 210, 225, 234 or 305 or equivalent.

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)

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)

CSCD 599 Independent Study (1-6)

Prerequisite: permission of the instructor, department chair and college dean.

CSCD 600 Thesis (2-16)

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)

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 695 Departmental Internship (2-12)

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.

