

COMPUTER SCIENCE

Majors:

- Bachelor of Science, Computer Information Systems (p. 1)
- Bachelor of Science, Computer Science (p. 2)

Minors:

- Computer Information Systems (p. 4)
- Computer Science (p. 4)

The Department of Computer Science offers two programs leading to a Bachelor of Science degree in either computer science or computer information systems. Both programs require similar introductory core sequence of courses in computer science. The main differences between the two programs are in the mathematics and science requirements and in the application emphases.

Computer Science

Computer science is the study of algorithms and their implementation as applications (apps). This includes the study of data structures, software design, programming languages, operating systems, and computer architecture. Each student must take appropriate upper-level electives from any concentration areas of virtual/augmented reality and game development; cybersecurity and computer networks; theory of computation; software engineering and project management; and machine learning, autonomous systems, and data science.

Computer Information Systems

This program emphasizes computer science concepts with particular attention to systems analysis and design, and includes a concentration area or minor chosen by the student in consultation with the student's advisor.

Both of these B.S. programs provide a foundation for students to embark on successful careers in a variety of computing disciplines, including software engineering, system design, database management, data science, autonomous systems, ambient intelligence, gaming, cyber security, computer networking, systems programming, and systems administration. In addition, graduates will be prepared to pursue graduate study in computer science and related disciplines.

Computer Science and Computer Information Systems majors are required to attain grades of C- or better in the following courses: CPS 150, CPS 151, and CPS 350.

A minor in computer science consists of 20 semester hours. A minor in computer information systems consists of 23 semester hours.

Faculty

Mehdi Zargham, Chairperson

Professors Emeriti: Courte, Kester, Lang, Smith, Winslow

Distinguished Research Professor: Baldwin

Professors: Perugini, Sritharan, Zargham

Associate Professors: Buckley, Gowda, Nguyen, Shen, Yao

Assistant Professors: Chen, Nguyen, Phung, Shekarpour

Visiting Professor: Kirbas

Lecturers: Bashias, Sanyal

Bachelor of Science, Computer Information Systems (CIS) minimum 120 hours

Common Academic Program (CAP) ¹

First-Year Humanities Commons ²	12
	cr.
	hrs.
HST 103	The West & the World
REL 103	Introduction to Religious and Theological Studies
PHL 103	Introduction to Philosophy
ENG 100	Writing Seminar I ³
Second-Year Writing Seminar ⁴	0-3
	cr.
	hrs.
ENG 200	Writing Seminar II
Oral Communication	3
	cr.
	hrs.
CMM 100	Principles of Oral Communication
Mathematics	3
	cr.
	hrs.
Social Science	3
	cr.
	hrs.
SSC 200	Social Science Integrated
Arts	3
	cr.
	hrs.
Natural Sciences ⁵	7
	cr.
	hrs.
Crossing Boundaries	up
	to
	12
	cr.
	hrs.
Faith Traditions	
Practical Ethical Action Inquiry ⁶	
Integrative	
Advanced Study	
Philosophy and/or Religious Studies (6 cr. hrs.)	
Historical Studies (3 cr. hrs.) ⁷	
Diversity and Social Justice ⁸	3
	cr.
	hrs.
Major Capstone ⁹	0-6
	cr.
	hrs.

- ¹ The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.
- ² May be completed with ASI 110 and ASI 120 through the Core Program.
- ³ May be completed with ENG 100A and ENG 100B, by placement.
- ⁴ May be completed with ENG 114 or ENG 198 or ASI 120.
- ⁵ Must include two different disciplines and at least one accompanying lab.
- ⁶ U.S. History AP and CLEP credit will not satisfy this requirement.
- ⁷ May be completed with ASI 110 and ASI 120 through the Core Program. U.S. History AP and CLEP credit will not satisfy this requirement.
- ⁸ May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.
- ⁹ The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Science Breadth Requirements

Mathematics ¹ 9

MTH 116 Precalculus Math
&

MTH 148 Introductory Calculus I (Satisfies CAP Mathematics)

OR

MTH 148 Introductory Calculus I

&

MTH 149 Introductory Calculus II

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MTH 207 Introduction to Statistics

OR

MTH 367 Statistical Methods I

Natural Sciences (Applies to CAP Natural Science) ¹ 8

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Select two lecture/lab pairs from:

BIO 151 Concepts of Biology I: Cellular & Molecular Biology & 151L and Concepts of Biology Laboratory I: Cellular & Molecular Biology

BIO 152 Concepts of Biology II: Evolution & Ecology and Concepts of Biology Laboratory II: Evolution & Ecology

CHM 123 General Chemistry and 123L and General Chemistry Laboratory

CHM 124 General Chemistry and 124L and General Chemistry Laboratory

GEO 115 Physical Geology and 115L and Physical Geology Laboratory

GEO 116 Geological History of the Earth and 116L and Geological History of the Earth Laboratory

PHY 201 & 201L	College Physics I and College Physics Laboratory I
PHY 202 & 202L	College Physics II and General Physics Laboratory
PHY 206 & PHY 210L	General Physics I - Mechanics and General Physics Laboratory I
PHY 207 & PHY 211L	General Physics II - Electricity & Magnetism and General Physics Laboratory II

Major Requirements 65

CPS 149	Creative Media Applications	3
CPS 150	Algorithms & Programming I	4
CPS 151	Algorithms & Programming II	4
CPS 242	Web Application Development	3
CPS 310	Systems Analysis	3
CPS 341	Discrete Structures	3
CPS 350	Data Structures & Algorithms	3
CPS 430	Database Management Systems	3
CPS 490	Capstone I (Satisfies CAP Major Capstone)	3
CPS 491	Capstone II	3

Select five CPS courses (15 hrs., numbered higher than 310)

Minor Concentration

18 Credit Hrs.

Any minor program of study chosen by the student and approved by the student's academic advisor. This choice should involve an area where the student might apply skills acquired through this program.

Breadth

ASI 150	Introduction to the University Experience	1
PHL 319	Information Ethics (Satisfies CAP Practical Ethical Action and Adv Studies in PHL)	3

Social and Behavioral Sciences (includes CAP Social Science) ¹ 6

Total Hours to total at least 120

¹ This requirement, and CAP components, will be satisfied in some cases by the minor that is chosen.

Bachelor of Science, Computer Science (CPS) minimum 120 hours

Common Academic Program (CAP) ¹

First-Year Humanities Commons ² 12 cr. hrs.

HST 103 The West & the World

REL 103 Introduction to Religious and Theological Studies

PHL 103 Introduction to Philosophy

ENG 100 Writing Seminar I ³

Second-Year Writing Seminar ⁴ 0-3 cr. hrs.

ENG 200 Writing Seminar II

Oral Communication 3 cr. hrs.

CMM 100 Principles of Oral Communication

Mathematics	3	cr. hrs.
Social Science	3	cr. hrs.
SSC 200 Social Science Integrated		
Arts	3	cr. hrs.
Natural Sciences ⁵	7	cr. hrs.
Crossing Boundaries	up to 12	cr. hrs.
Faith Traditions		
Practical Ethical Action Inquiry ⁶		
Integrative		
Advanced Study		
Philosophy and/or Religious Studies (6 cr. hrs.)		
Historical Studies (3 cr. hrs.) ⁷		
Diversity and Social Justice ⁸	3	cr. hrs.
Major Capstone ⁹	0-6	cr. hrs.

¹ The credit hours listed reflect what is needed to complete each CAP component. However, they should not be viewed as a cumulative addition to a student's degree requirements because many CAP courses are designed to satisfy more than one CAP component (e.g., Crossing Boundaries and Advanced Studies) and may also satisfy requirements in the student's major.

² May be completed with ASI 110 and ASI 120 through the Core Program.

³ May be completed with ENG 100A and ENG 100B, by placement.

⁴ May be completed with ENG 114 or ENG 198 or ASI 120.

⁵ Must include two different disciplines and at least one accompanying lab.

⁶ U.S. History AP and CLEP credit will not satisfy this requirement.

⁷ May be completed with ASI 110 and ASI 120 through the Core Program. U.S. History AP and CLEP credit will not satisfy this requirement.

⁸ May not double count with First-Year Humanities Commons, Second-Year Writing, Oral Communication, Social Science, Arts, or Natural Sciences CAP components, but may double count with courses taken to satisfy other CAP components and/or courses taken in the student's major.

⁹ The course or experience is designed by faculty in each major; it may, or may not, be assigned credit hours.

Science Breadth Requirements

MTH 168	Analytic Geometry & Calculus I (Satisfies CAP Mathematics)	4
MTH 169	Analytic Geometry & Calculus II	4
MTH 218	Analytic Geometry & Calculus III	4
MTH 301	Matrix Theory and Applications	3
MTH 367	Statistical Methods I	3
Select one natural sciences group from (Applies to CAP Natural Sciences):		8
BIO 151 & 151L & BIO 152 & BIO 152L	Concepts of Biology I: Cellular & Molecular Biology and Concepts of Biology Laboratory I: Cellular & Molecular Biology and Concepts of Biology II: Evolution & Ecology and Concepts of Biology Laboratory II: Evolution & Ecology	
CHM 123 & 123L & CHM 124 & CHM 124L	General Chemistry and General Chemistry Laboratory and General Chemistry and General Chemistry Laboratory	
GEO 115 & 115L & GEO 116 & GEO 116L	Physical Geology and Physical Geology Laboratory and Geological History of the Earth and Geological History of the Earth Laboratory	
PHY 206 & PHY 207 & PHY 210L & PHY 211L	General Physics I - Mechanics and General Physics II - Electricity & Magnetism and General Physics Laboratory I and General Physics Laboratory II	
Natural Sciences ²		6

Major Requirements 50

CPS 149	Creative Media Applications	3
CPS 150	Algorithms & Programming I	4
CPS 151	Algorithms & Programming II	4
CPS 250	Computer Organization and Architecture	3
CPS 341	Discrete Structures	3
CPS 350	Data Structures & Algorithms	3
CPS 352	Concepts and Implementation of Programming Languages	3
CPS 356	Operating Systems: Modern Mobile Devices and Massive Concurrency	3
CPS 450	Design and Analysis of Algorithms (Satisfies CAP Integrative)	3
CPS 470	Computer Networks and Security	3
CPS 490	Capstone I (Satisfies CAP Major Capstone)	3
CPS 491	Capstone II	3
Select four CPS courses (300/400 level) ³		12

Breadth

ASI 150	Introduction to the University Experience	1
PHL 319	Information Ethics (Satisfies CAP Practical Ethical Action and Adv Studies in PHL)	3
or PHL 312	Ethics	
or PHL 316	Engineering Ethics	
or PHL 321	Environmental Ethics	

Social and Behavioral Sciences (Includes CAP Social Science)	6
Total Hours to total at least	120

- ¹ CPS 353 will not count towards major requirement.
- ² Select two acceptable courses for Science or Engineering majors.
- ³ These courses may be taken from any area as defined by the department. At least three courses in an area are required for obtaining a concentration.

Minor in Computer Information Systems (CIS)

Computer Information Systems

CPS 150	Algorithms & Programming I	4
CPS 151	Algorithms & Programming II	4
CPS 242	Web Application Development	3
CPS 310	Systems Analysis	3
CPS 312	Systems Design	3
Select two CPS courses (320 level or above)		6
Total Hours		23

Minor in Computer Science (CPS)

Computer Science

CPS 149	Creative Media Applications	3
CPS 150	Algorithms & Programming I	4
CPS 151	Algorithms & Programming II	4
CPS 350	Data Structures & Algorithms	3
CPS 430	Database Management Systems	3
Select one 400 level CPS course		3
Total Hours		20

- Bachelor of Science, Computer Information Systems (p. 1)
- Bachelor of Science, Computer Science (p. 4)

Computer Information Systems

First Year

Fall	Hours	Spring	Hours
ASI 150		1 CPS 150	4
CPS 149		3 MTH 148	3
MTH 116		4 CAP Natural Science w/ lab	4
ENG 100 (CAP Humanities Commons)		3 REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
REL 103, PHL 103, or HST 103 (CAP Humanities Commons)		3 CMM 100 (CAP Communication)	3
REL 103, PHL 103, or HST 103 (CAP Humanities Commons)		3	3
		17	17

Second Year

Fall	Hours	Spring	Hours
CPS 151		4 CPS 242	3
CPS 341		3 CPS 350	3

MTH 207	3 Science w/ lab (Satisfies CAP Natural Science)	4
Course for chosen minor ¹	3 Course for chosen minor ¹	3
ENG 200 (CAP Writing Seminar)	3 SSC 200 (CAP Social Science)	3
		16
		16

Third Year

Fall	Hours	Spring	Hours
CPS 310		3 CPS Elective	3
CPS 430		3 CPS Elective	3
Course for chosen minor ¹		3 Course for chosen minor ¹	3
Course for chosen minor ¹		3 Course for chosen minor ¹	3
CAP Arts		3 PHL 319 (Satisfies CAP Adv. Philosophy, Practical Ethical Action)	3
		CAP Adv. Philosophy/Religious Studies (Faith Traditions)	3
		15	18

Fourth Year

Fall	Hours	Spring	Hours
CPS 490		3 CPS 491	3
CPS Elective		3 CPS Elective	3
Social Science Elective		3 CPS Elective	3
CAP Advanced Historical Studies		3 CAP Integrative	3
CAP Inquiry		3 CAP Diversity and Social Justice	3
		15	15

Total credit hours: 129

¹ The requirements for the Bachelor of Science in Computer Information Systems include a minor chosen by the student in consultation with the student's academic advisor.

Computer Science

First Year

Fall	Hours	Spring	Hours
ASI 150		1 CPS 150	4
CPS 149 (CAP Natural Science)		3 MTH 169	4
MTH 168 (Satisfies CAP Mathematics)		4 CAP Natural Science w/ lab	4
Science w/lab		4 REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3

ENG 100 (CAP Humanities Commons)	3	REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3
REL 103, PHL 103, or HST 103 (CAP Humanities Commons)	3		
		18	18
Second Year			
Fall	Hours	Spring	Hours
CPS 151		4 CPS 250	3
CPS 341		3 CPS 350	3
MTH 218		4 MTH 301	3
ENG 200 (CAP Writing Seminar)		3 CMM 100 (CAP Communication)	3
SSC 200 (CAP Social Science)		3 CAP Arts	3
		17	15
Third Year			
Fall	Hours	Spring	Hours
CPS 352		3 CPS 356	3
MTH 367		3 CPS elective	3
CPS 450 (Satisfies CAP Integrative)		3 Science elective	3
Science elective		3 Social Science - elective	3
CAP Faith Traditions		3 PHL 319 (Satisfies CAP Adv. Philosophy, Practical Ethical Action)	3
		15	15
Fourth Year			
Fall	Hours	Spring	Hours
CPS 490		3 CPS 491 (Satisfies CAP Major Capstone)	3
CPS elective		3 CPS elective	3
CPS elective		3 CPS elective	3
CAP Inquiry		3 CAP Advanced Historical Studies	3
CAP Advanced Philosophy/Religious Studies		3 CAP Diversity and Social Justice	3
		15	15

Total credit hours: 128

Courses

CPS 111. Introduction to Personal Computers. 3 Hours

Emphasis on use of operating system, particularly file organization, and applications: word processor, spreadsheet, database and presentation software.

CPS 132. Computer Programming for Engineering & Science. 3 Hours

Fundamentals of computer programming including algorithms, program structure, library routines, debugging, and program verification. Calculus-based computer solutions of problems from science and engineering using C++. Corequisite(s): MTH 168.

CPS 144. Introduction to Computer Programming. 3 Hours

Fundamentals of computer programming including algorithms, program structure, library routines, debugging, and program verification. Computer solutions of problems from social sciences using a suitable compiler language such as Visual Basic.

CPS 149. Creative Media Applications. 3 Hours

Multidisciplinary, project-driven learning process courses that encourages students to develop problem solving and teamwork skills while fostering creativity and logic. The goal is not only to provide students with some "programming maturity," but to also engage them through working in small teams on existing projects related to their discipline and interest. Projects may include creative animations and games, mobile app developments, or avatars.

CPS 150. Algorithms & Programming I. 4 Hours

Introduction to computers and programming using a high-level, structured language. Topics include problem solving, algorithms, programming constructs, data representation, stepwise refinement, and debugging.

CPS 151. Algorithms & Programming II. 4 Hours

Algorithms and Programming II covers object-oriented design and development, data abstraction, exception handling, linked lists, stacks, queues, binary trees, and recursion using a high level, structured language. Prerequisite(s): CPS 150.

CPS 242. Web Application Development. 3 Hours

Web application development using the state-of-the-art environments such as markup languages, scripting languages, dynamic web pages, server side technologies, and database access. Prerequisite(s): CPS 151.

CPS 250. Computer Organization and Architecture. 3 Hours

Machine and assembly language instructions, and writing assembly programs. Design of basic logic circuits needed in constructing a computer. Design of circuits for information encoding, arithmetic units, and transferring and storing information. Data path and control unit for a simple processor. Multiprocessing and alternative parallel systems. Prerequisite(s): CPS 151.

CPS 309. Topics in Computer Science. 1-4 Hours

Lectures or laboratory work in areas of current interest. May be taken more than once. Does not count as upper level credit for majors/minors.

CPS 310. Systems Analysis. 3 Hours

Methodologies for developing software, software development life cycles, data flow approach for system development, data dictionary, process specification, input/output design, E-R diagrams, normalization, and introduction to object-oriented analysis. Prerequisite(s): CPS 151.

CPS 312. Systems Design. 3 Hours

Software design process; developing structured design (e.g., structure charts) from data flow approach using coupling, cohesion, and other design guidelines; fine-tuning object-oriented analysis model to design using design patterns, and implementation. Prerequisite(s): CPS 310.

CPS 341. Discrete Structures. 3 Hours

Propositional logic, Boolean algebra, predicate logic, logical deductions, proof techniques, sets, combinatorics, recurrences, functions, relations, discrete structures such as graphs, digraphs, and associated algorithms. Prerequisite(s): CPS 150.

CPS 343. Comparative Languages. 3 Hours

Language design issues, formal syntax specification, data types and storage methods, activation records and procedural object oriented, functional, and logic programming paradigms. Prerequisite(s): CPS 350.

CPS 350. Data Structures & Algorithms. 3 Hours

Dynamic nonlinear data structures including trees, binary trees, search trees, balanced search trees, priority queues, and graphs, with an emphasis on their implementation, uses, and associated algorithms. Analysis of the computational complexity of algorithms related to these structures. Prerequisite(s): CPS 151.

CPS 352. Concepts and Implementation of Programming Languages. 3 Hours

Study of programming language concepts through the implementation of interpreters and assessment of the conceptual differences in the resulting languages. Concepts covered include syntax and semantics, regular and context-free grammars, parsing, binding, scope, parameter passing, lazy evaluation, types, currying, and continuations. A comparative survey of the imperative, functional, logical, and object-oriented paradigms of programming is presented. Prerequisite(s): CPS 350.

CPS 353. Numerical Methods I. 3 Hours

Study of the algorithms of numerical mathematics with emphasis on interpolation, the solution of nonlinear equations, and linear systems of equations including matrix methods; analysis of errors associated with the algorithms. Prerequisite(s): (CPS 132 or CPS 150); MTH 169.

CPS 356. Operating Systems. 3 Hours

Introduces the theoretical and practical concepts underlying an operating system's structure and operation. Topics include process and thread creation and management, scheduling, concurrent, multi-threaded programming and synchronization, deadlock, memory management, virtual memory, and computer security. Prerequisite(s): (CPS 250 or ECE 314) and CPS 350.

CPS 410. User Interface Design and Development. 3 Hours

Addresses the practical problems of designing interfaces for modern software as well as other interactive media. Topics include interaction framework and styles, design principles, design models, new interactive technologies, usability testing and facets of interaction. Group activities and project work is an integral part of this course. Prerequisite(s): CPS 350.

CPS 415. Software Testing and Security Analysis. 3 Hours

Detailed examination of the software testing and security analysis process. Topics include testing methodologies, code analysis techniques, and secure programming principles and practices. Prerequisite(s): CPS 350.

CPS 420. Software Engineering. 3 Hours

Provides an overview of the software engineering discipline. Topics include software processes, requirements engineering, system modeling, architectural design, software testing, dependability and security, software reuse, distributed software engineering, project planning, quality management, configuration management, and process improvement. Prerequisite(s): CPS 350.

CPS 422. Software Project Management. 3 Hours

Introduction to software project management. Topics include process models for software development, project planning techniques, estimation techniques, measuring and controlling work products and processes, managing project risk, teams and communication, and organizational issues. Prerequisite(s): CPS 310.

CPS 430. Database Management Systems. 3 Hours

Physical and logical organization of databases: the entity-relationship model; relational database model; the data definition and data manipulation language of a commercial database management system; integrity constraints; conceptual database design. Prerequisite(s): CPS 350.

CPS 432. Database Management Systems II. 3 Hours

Study of query execution and optimization, transaction management, concurrency control, recovery and security techniques. Advanced data models and emerging trends in database systems, like object oriented database systems, distributed database systems, the client-server architecture, multidatabase and heterogeneous systems. Other current database topics and emerging technologies will be discussed. Prerequisite(s): CPS 430.

CPS 433. Cyber Forensics. 3 Hours

Preserving, recovering, and analyzing digital evidence found in physical and virtual worlds. Topics include data and information retrieval; computer/media forensic analysis, techniques, and tools; and basic criminal law concepts. Prerequisite(s): CPS 356.

CPS 434. Big Data and Cloud Computing. 3 Hours

This course introduces students to distributed computation frameworks (such as MapReduce) associated with massive datasets. Topics focus on parallel/distributed algorithms, data mining and machine learning algorithms for processing and analyzing very large amounts of data, and data visualization. Prerequisite(s): CPS 434.

CPS 437. System Architectures & Networking. 3 Hours

Issues and techniques used in the physical design of computer-based information systems. Basic operating systems, hardware architecture and networking principles. Intended for students majoring in MIS; not open to students majoring in CPS, CIS, or PCS. Prerequisite(s): MIS 380, MIS 385.

CPS 444. UNIX/Linux Programming. 3 Hours

Prepares students for developing software in the UNIX/Linux environment using the C programming language. Topics include system libraries and system calls, shells, system structures and internals, interprocess communication (pipes and signals), network programming (client-server model and sockets), pattern matching and filters, shell programming, automatic program generation, and GUI programming. Prerequisite(s): CPS 356.

CPS 450. Design and Analysis of Algorithms. 3 Hours

Introduction to order notation and algorithm analysis. Emphasis will be on learning algorithm design techniques such as divide and conquer, greedy approach, and dynamic programming through exposition of classical algorithms from domains such as sorting, string matching, and graph algorithms. Hardness of problems and introduction to the complexity classes P, NP, and NP-complete. Topics also include impact of computing techniques to the improvement or welfare of society as a whole. Prerequisite(s): CPS 341, CPS 350.

CPS 452. Emerging Programming Languages. 3 Hours

Exploration of recent trends and developments in programming languages, research and practice. Topics include new concurrency and object models, type systems, functional programming, metaprogramming, multi-paradigm languages, and domain-specific languages. Prerequisite(s): CPS 350.

CPS 455. Computer Architecture and Design. 3 Hours

Provides a foundation for understanding and evaluating the design principles incorporated in modern computers. Topics include history and classification of computers, instruction-level, data-level, and thread-level parallelism. Prerequisite(s): CPS 250, CPS 350.

CPS 460. Computer Graphics. 3 Hours

Introduction to primitives and interactive graphics software development. Topics include transforms, clipping, modeling, rendering, texture, animation, and ray tracing. Prerequisite(s): CPS 350.

CPS 465. Interactive Media. 3 Hours

Provides an exposure to the capabilities of new digital tools to create new experiences. Topics include tools/techniques for collecting, analyzing, and visualizing 3D data; interactive audio/video using motion/light detectors; mobile interfaces; animation; smart rooms; and social networks. Prerequisite(s): CPS 350.

CPS 470. Computer Networks and Security. 3 Hours

Computer Networks and Security focus on Internet protocols and secure protocols. Topics include the web, domain name systems, reliable data transfer, flow control, congestion control, routing, wireless networks, secure computing, Internet vulnerability and security. Prerequisites: CPS 350.

CPS 471. Fundamentals of Cyber Security. 3 Hours

This course introduces the student to the theoretical basis of cyber security and provides practical experience in hardening a system against cyber attacks. The course explains the essential concepts of cyber security and applies those concepts to a modern networked operating system via course lectures and a project. Prerequisite(s): CPS 341.

CPS 472. Computer and Network Security. 3 Hours

Computer and Network Security covers information protection. Topics includes techniques for security in multi-user and distributed systems, principles of secure design, cryptography, authentication, access-control, intrusion detection and viruses, firewalls, wireless security, cracking WEP keys, and VPN security. Prerequisite(s): CPS 356.

CPS 473. Reverse Code Engineering. 3 Hours

Study theories on the application of cyber power to achieve certain objectives. Topics includes cyber policy, tracing strategy, targeting, cyber intelligence, measuring effects, and legal and ethical issues. Prerequisite(s): CPS 350.

CPS 474. Software Security. 3 Hours

Introduction to the fundamental topics of software vulnerabilities and attacks together with the countermeasures to prevent the attacks. Covered concepts include vulnerability taxonomies such as CVE, race conditions, buffer overflows, privilege escalation attacks, input validation issues, trust relationships, web security, mobile security, and cutting-edge security research. Prerequisite(s): CPS 341 and CPS 350.

CPS 475. Secure Application Development. 3 Hours

This course introduces secure programming principles and practices to develop robust, secure software systems that are free from vulnerabilities. Constructive secure programming techniques are integrated with modern application development technologies so that security can be built-in during the design phase in the development process to avoid potential software vulnerabilities and attacks. Prerequisite(s): CPS 341 and CPS 350.

CPS 477. Honors Thesis. 3 Hours

First of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approval of University Honors Program.

CPS 478. Honors Thesis. 3 Hours

Second of two courses leading to the selection, design, investigation, and completion of an independent, original Honors Thesis project under the guidance of a faculty research advisor. Restricted to students in the University Honors Program with permission of the program director and department chairperson. Students pursuing an interdisciplinary thesis topic may register for three semester hours each in two separate disciplines in consultation with the department chairpersons. Prerequisite(s): Approved 477; approval of University Honors Program.

CPS 480. Artificial Intelligence. 3 Hours

Fundamentals concepts and techniques of intelligent systems. Topics includes knowledge representation, search strategies, predicate logic, and expert systems. Prerequisite(s): CPS 350.

CPS 481. Intelligent Systems and Machine Learning. 3 Hours

State-of-art techniques in building intelligent systems. Topics include soft computing, agents and multiagent systems, and machine learning. Prerequisite(s): CPS 350.

CPS 482. Automata Theory. 3 Hours

Formal languages (regular, context-free, recursive, and recursively enumerable), machine models (deterministic and non-deterministic finite automata, push down automata, Turing machines), grammars (regular, context-free, and unrestricted), interplay among these concepts, Church-Turing thesis, and undecidability. Prerequisite(s): CPS 341.

CPS 483. Graph Algorithms. 3 Hours

Design and analysis of algorithms for problems based on graphs. Classical algorithms and efficient algorithms for restricted domains of graphs will be covered. Analysis of algorithms, complexity classes P, NP, and NP-complete, traversals, bi-connectedness, strongly-connectedness, 2-SAT, planarity testing, and algorithms for restricted classes of graphs. Prerequisite(s): CPS 341, CPS 350.

CPS 485. Evolutionary Computation. 3 Hours

The history and use of Evolutionary Computation (EC) are explored. Popular approaches to EC (genetic algorithms, genetic programming, evolution strategies, evolutionary programming) are defined and discussed. Coursework includes implementation of evolutionary techniques and review and analysis of literature in the field. Prerequisite(s): CPS 350.

CPS 490. Capstone I. 3 Hours

Examination of principles, practices, and methodology for development of large software systems using data flow and object-oriented methodologies. User interface design, software testing, and software project management. Selecting and planning a team project; this involves team formation, project selection, project planning, and proposal writing and presentation. Prerequisite(s): CPS 350.

CPS 491. Capstone II. 3 Hours

An exercise in the design, implementation, documentation, and deployment of a group project culminating in a presentation to the computer science faculty and industry representatives. Prerequisite(s): CPS 490.

CPS 496. Cooperative Education. 1-3 Hours

Computer science cooperative education work experience in an approved organization. Not open to students with credit in CPS 497. Credit does not apply to major requirements. Repeat to a maximum of three semester hours. Prerequisite(s): Twelve hours of upper-level CPS courses with a GPA of 3.0; total ninety semester hours with a GPA of 2.75; permission of the department in advance of the work.

CPS 497. Internship. 1-3 Hours

Computer science work experience in an approved organization.

Not open to students with CPS 496 credit. Credit does not apply to major requirements. Repeat to a maximum of three semester hours.

Prerequisite(s): Twelve semester hours of upper-level CPS courses with GPA of 3.0; total ninety semester hours and 2.75 GPA; permission of department in advance of the work.

CPS 498. Problems in Computer Science. 1-4 Hours

Individual readings and research in a specialized area. (See CPS 499.)

By arrangement. May be taken more than once for additional credit.

Prerequisite(s): Permission of department chairperson.

CPS 499. Special Topics in Computer Science. 1-4 Hours

Lectures or laboratory work in advanced topics from the various areas of computer science. By arrangement. May be taken more than once.

Prerequisite(s): Permission of department chairperson.