

COMPUTER & INFO SCIENCE (CIS)

CIS 100 Selected Topics (1-6 Credits)

Engineering & Comp Sci

Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester. Repeatable

CIS 151 Fundamentals of Computing and Programming (3 Credits)

Engineering & Comp Sci

Principles and practice of programming. Computing fundamentals: variables, types, scope, objects, classes, functions, parameter passing, input/output, conditionals, and iteration. Defensive programming techniques, including exceptions. Program testing and debugging. Includes programming laboratory.

Shared Competencies: Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 180 International Course (1-12 Credits)

Engineering & Comp Sci

Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the SU academic department to assign the appropriate course level, title, and grade for the student's transcript.

Repeatable

CIS 182 Intro to Comput Prog:Apl (1-2 Credits)

Engineering & Comp Sci

CIS 183 Intr to Comp Prog:Fortran (1 Credit)

Engineering & Comp Sci

CIS 187 Intro to Comp Prog:Pascal (1 Credit)

Engineering & Comp Sci

CIS 200 Selected Topics (1-6 Credits)

Engineering & Comp Sci

Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester. Repeatable

CIS 205 Survey of Comp & Info Sci (0-3 Credits)

Engineering & Comp Sci

CIS 223 Statistical Reasoning and Practice (3 Credits)

Engineering & Comp Sci

Methods for exploratory data analysis. Graphical and numerical summaries of numerical and categorical data. Drawing conclusions from data. Basic probability, correlation, estimation and testing. Concepts of study design.

Prereq: MAT 194

CIS 252 Elements of Computer Science (4 Credits)

Engineering & Comp Sci

Introduction to key computer-science concepts through functional programming. Recursion, data representation, data abstraction, and computational patterns. Algebraic data types and higher-order functions. Models of computation. Three hours of lecture and one hour of computer laboratory.

Prereq: CIS 151 or CPS 196

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 270 Experience Credit (1-6 Credits)

Engineering & Comp Sci

Participation in a discipline or subject related experience. Student must be evaluated by written or oral reports or an examination. Permission in advance with the consent of the department chairperson, instructor, and dean. Limited to those in good academic standing.

Repeatable

CIS 280 International Course (1-12 Credits)

Engineering & Comp Sci

Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the S.U. academic department to assign the appropriate course level, title, and grade for the student's transcript.

Repeatable

CIS 285 Computer Applications (0 Credits)

Engineering & Comp Sci

CIS 290 Independent Study (1-6 Credits)

Engineering & Comp Sci

Exploration of a problem, or problems, in depth. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor(s) and the department.

Repeatable

CIS 300 Selected Topics (1-6 Credits)

Engineering & Comp Sci

Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester. Repeatable

CIS 321 Introduction to Probability and Statistics (4 Credits)

Engineering & Comp Sci

Double-numbered with CPS 621

Programming-oriented introduction to fundamentals in statistics and probability; elementary statistics, graphical and numerical representation; probability distributions; tests and confidence intervals; regression, and correlation. CPS 621 adds Journalism applications of statistical methods.

Prereq: MAT 295

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 341 Computer Organization & Programming Systems (3 Credits)*Engineering & Comp Sci*

Digital logic, data types and their representations, instruction set architecture, assembly language, program construction, processors, memory hierarchy, traps and interrupts, privilege and security, input-output subsystems.

Prereq: CIS 351

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 342 Introduction to Systems Programming (1 Credit)*Engineering & Comp Sci*

Input and output, including error handling, file descriptors and interface to OS. Pointers and pointer arithmetic. Structures. Memory functions and storage allocation. Makefiles, header files, libraries, compilation, and linking.

Prereq: CIS 351; Coreq: CIS 341

CIS 351 Data Structures (3 Credits)*Engineering & Comp Sci*

Abstract data structures including arrays, lists, trees, binary search trees, priority queues, graphs. Algorithm analysis. Examples include data structures used for security-related applications.

Prereq: CIS 252 or CSE 283

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 352 Programming Language: Theory & Practice (3 Credits)*Engineering & Comp Sci*

Environments, stores, scoping, functional and imperative languages, modules, classes, data encapsulation, types, and polymorphism. Implementation of these constructs in a definitional interpreter.

Prereq: CIS 252, 375, and 351

CIS 355 Intrm Prog/High Levl Lang (0 Credits)*Engineering & Comp Sci***CIS 370 Experience Credit (1-6 Credits)***Engineering & Comp Sci*

Participation in a discipline or subject related experience. Student must be evaluated by written or oral reports or an examination. Permission in advance with the consent of the department chairperson, instructor, and dean. Limited to those in good academic standing.

Repeatable

CIS 375 Introduction to Discrete Mathematics (3 Credits)*Engineering & Comp Sci*

Basic set theory and symbolic logic. Methods of proof, including mathematical induction. Relations, partitions, partial orders, functions, and graphs. Credit cannot be given for both MAT 375 and CIS 375.

Prereq: PHI 251

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>)

CIS 380 International Course (1-12 Credits)*Engineering & Comp Sci*

Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the S.U. academic department to assign the appropriate course level, title, and grade for the student's transcript.

Repeatable

CIS 381 Programming Systems (3 Credits)*Engineering & Comp Sci***CIS 383 Cmp Appl & Prog/Soc Rsrch (3 Credits)***Engineering & Comp Sci***CIS 386 Principles of Computer System Design (3 Credits)***Engineering & Comp Sci*

Fundamental design principles for computer and information systems. Concurrency, race conditions, complexity, modularity, abstraction, layering, hierarchy, iteration, emergent properties, organization, virtualization, performance, atomicity, fault tolerance, consistency, and security.

Prereq: ECS 102 and CIS 351

CIS 390 Honors Seminar in Computer & Information Science (3 Credits)*Engineering & Comp Sci*

Specific topics in computer and information science suitable for honors-thesis research.

Repeatable

CIS 400 Selected Topics (1-6 Credits)*Engineering & Comp Sci*

Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.

Repeatable

CIS 415 Intro Comp Linguistics (0 Credits)*Engineering & Comp Sci***CIS 425 Introduction to Computer Graphics (3 Credits)***Engineering & Comp Sci*

Graphics programming. User interfaces. Modeling and viewing transformations. Shading techniques. Representations of three-dimensional models. Curves and non-planar surfaces. Ray tracing and radiosity. Antialiasing.

Prereq: CIS 351 or CSE 382

Shared Competencies: Communication Skills (<https://coursecatalog.syracuse.edu/shared-competencies/communication-skills/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 428 Introduction to Cryptography (3 Credits)*Engineering & Comp Sci*

Classical cryptosystems and their cryptanalysis, RSA and other public-key cryptosystems, pseudo-random sequences, zero-knowledge protocols, related ethical and social concerns.

Prereq: CIS 477 or MAT 534 or 541

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 437 Multiagent Systems: Concepts and Programming (3 Credits)*Engineering & Comp Sci*

Double-numbered with CIS 637

Algorithms for multiagent systems. Environment types for agent systems. Communications, game theoretical models, automatic auctions, utility and decision theory for multiagent systems, relationships between distributed systems and multiagent systems, Belief-Desire-Intention architecture, logic-based agent models, and agent simulations. Additional work required for graduate students.

Prereq: CIS 375 and CIS 351

Shared Competencies: Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 440 Topics in Mobile Programming (3 Credits)*Engineering & Comp Sci*

Double-numbered with CIS 640, CSE 640

A variety of subjects surveyed or a particular subject in depth. Additional coursework required of graduate students.

Repeatable 3 times for 9 credits maximum

Prereq: CIS 351

CIS 442 Introduction to Virtual Reality (3 Credits)*Engineering & Comp Sci*

Fundamental aspects of virtual environments: applications, methods, and technologies. Development of 3D applications such as games, animations, and immersive virtual worlds. Aspects of 3D graphics (3D transformations and physics) and interactive systems (human perception and motion tracking).

Advisory recommendation Prereq: CIS 351 or CSE 283

CIS 444 Mobile Application Programming (3 Credits)*Engineering & Comp Sci*

Cross-listed with CSE 444

Double-numbered with CIS 651, CSE 651

Development of applications for different mobile devices. Creating effective user interfaces, efficient use of persistent storage, network services, GPS, maps and sensors. Additional work required of graduate students.

Prereq: CIS 351 or CSE 382

CIS 445 Finite Mathematics (3 Credits)*Engineering & Comp Sci***CIS 451 Modern Programming in Java (3 Credits)***Engineering & Comp Sci*

Programming in Java with generic classes. Defining generic classes. Specifying types and inheritance. Verifying correctness of Java methods and classes. Managing concurrency, remote method invocation, and performance considerations.

CIS 453 Software Specification and Design (3 Credits)*Engineering & Comp Sci*

Software engineering process models. Software requirements analysis, including object-oriented methodology. Behavioral and nonbehavioral requirements. Development of specification documents. Unified Modeling Language. High-level design and software architecture. Team projects.

Prereq: CIS 351 or CSE 382

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 454 Software Implementation (3 Credits)*Engineering & Comp Sci*

Detailed design of software. Implementation and software testing.

Developing software implementations from UML specifications and design documents. Software development methodologies, including agile development. Ethics and social responsibility. Team projects.

Prereq: CIS 453

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 458 Data Networks: Basic Principles (3 Credits)*Engineering & Comp Sci*

Cross-listed with ELE 458, CSE 458

Data communication networks, multilayer network architecture, data transmission fundamentals, network protocols, local and wide area networks, transport and application protocols.

Prereq: CIS 321 or MAT 521

CIS 467 Introduction to Artificial Intelligence (3 Credits)*Engineering & Comp Sci*

Double-numbered with CIS 667, CSE 684

Knowledge representation, production systems, search algorithms, game playing, uncertainty handling, learning, automated reasoning, computer vision, and natural language processing. Programming project or term paper required for CIS 667, not for CIS 467.

Prereq: CIS 375 and 321 and (CIS 351 or CSE 382)

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>)

CIS 468 Natural Language Processing (3 Credits)*Engineering & Comp Sci*

Double-numbered with CIS 668

Linguistic and computational aspect of natural language processing technologies. Lectures, readings, and projects in the computational techniques required to perform all levels of linguistic processing of text. Additional work required of graduate students.

CIS 470 Experience Credit (1-6 Credits)*Engineering & Comp Sci*

Participation in a discipline- or subject-related experience. Students must be evaluated by written or oral reports or an examination. Limited to those in good academic standing.

Repeatable

CIS 471 Optimization Methods (3 Credits)*Engineering & Comp Sci*

Classical methods of minimum and maximum, gradient methods, conjugate direction methods, linear programming and simplex algorithm, integer programming, non-linear optimization, random search algorithms.

CIS 473 Automata and Computability (3 Credits)*Engineering & Comp Sci*

Countable and uncountable sets; diagonalization proofs; finite state automata; regular, context-free, context-sensitive, recursive, and r. e. languages; Turing machines; relationships between classes of languages and machines; the halting problem; proof methods for decidability and undecidability.

Prereq: CIS 375 or MAT 375

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 477 Introduction to Analysis of Algorithms (3 Credits)*Engineering & Comp Sci*

Mathematical modeling of computational problems; searching and sorting algorithms; search trees, heaps, and hash tables; divide-and-conquer, dynamic programming, and greedy choice design techniques; graph algorithms; cryptographic algorithms; NP-completeness; and selected topics.

Prereq: CIS 375 and 351

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 478 Introduction to Quantum Computing (3 Credits)*Engineering & Comp Sci*

Purpose of QC; simple Markov processes; quantum registers; quantum state transitions; classical vs quantum models of computation; measurement and superposition; no-cloning theorem; quantum teleportation; quantum logic.

Prereq: CIS 375 and (MAT 397 or 331)

CIS 480 International Course (1-6 Credits)*Engineering & Comp Sci*

Offered through SUABroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUABroad works with the S.U. academic department to assign the appropriate course level, title, and grade for the student's transcript.

Repeatable 1 times for 6 credits maximum

CIS 487 Access Control, Security and Trust (3 Credits)*Engineering & Comp Sci*

Cross-listed with CSE 487

Analytical/logical basis for trusting systems. Access requests, authorizations, certificates, credentials, jurisdiction, and delegation. Applications include distributed access control, process isolation and sharing, and access policies.

Prereq: CIS 375

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 489 Mobile Systems Security (3 Credits)*Engineering & Comp Sci*

Double-numbered with CIS 689

Components in Mobile OS; basic mobile app development; sandbox mechanism; permission enforcement; vulnerabilities; malware attacks. Additional work required of graduate students.

Prereq: CIS 486 or CSE 486

CIS 490 Independent Study (1-6 Credits)*Engineering & Comp Sci*

In-depth exploration of a problem or problems. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor or instructors and the department.

Repeatable

CIS 499 Honors Capstone Project (1-3 Credits)*Engineering & Comp Sci*

Completion of an Honors Capstone Project under the supervision of a faculty member.

Repeatable 3 times for 3 credits maximum

CIS 500 Selected Topics (1-6 Credits)*Engineering & Comp Sci*

Exploration of a topic (to be determined) not covered by the standard curriculum but of interest to faculty and students in a particular semester.

Repeatable

CIS 531 Compiler Construction (3 Credits)*Engineering & Comp Sci*

Programming a small compiler. Lexical analysis, tokens, finite automata, hashing. Syntax analysis, grammars, syntax trees, error recovery. Scope and type analysis, symbol tables. Run-time stack, variable addressing, expression evaluation, procedure activation, recursion. Code generation, Optimization, portability.

Prereq: CIS 351

CIS 535 Assembly Language (3 Credits)*Engineering & Comp Sci***CIS 536 Comp Prog Tech (3 Credits)***Engineering & Comp Sci***CIS 543 Control of Robots (3 Credits)***Engineering & Comp Sci*

Cross-listed with ELE 516

Kinematics, dynamics, and control of mobile and/or manipulator robots. Path planning, actuators, sensors, human/machine interface. Two hours lecture and two hours laboratory weekly. Design project.

CIS 545 Introduction to Combinatorics (3 Credits)*Engineering & Comp Sci*

Cross-listed with MAT 545

Permutations, combinations, recurrence relations, generating functions, inclusion-exclusion and applications, introductory graph theory.

Prereq: CIS 375 or MAT 375

Shared Competencies: Scientific Inquiry and Research Skills (<https://coursecatalog.syracuse.edu/shared-competencies/scientific-inquiry-and-research-skills/>)

CIS 553 Software Systems Implementation (3 Credits)*Engineering & Comp Sci*

Organization, analysis, and documentation of a sophisticated implementation project in a prominent high-level language, such as ADA, C, or Modular-2. Substantial programming assignments and analytical documentation. Language and project may vary from year to year.

Prereq: CIS 453

CIS 554 Object Oriented Programming in C++ (3 Credits)*Engineering & Comp Sci*

Pointers, dynamic memory management, data abstraction, classes, derived classes, inheritance, types, structures and templates. Threaded programming, standard template library, interfaces. Substantial programming assignments.

Prereq: CIS 351 or CSE 382

Shared Competencies: Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 563 Introduction to Data Science (3 Credits)*Engineering & Comp Sci*

Fundamentals of the knowledge discovery and data mining process. Basics of supervised and unsupervised learning. Applications (recommendation and collaborative filtering) and computational tools for carrying out predictive/descriptive modeling. Additional work required for graduate students.

Prereq: MAT 503

Shared Competencies: Critical and Creative Thinking (<https://coursecatalog.syracuse.edu/shared-competencies/critical-and-creative-thinking/>); Information Literacy and Technological Agility (<https://coursecatalog.syracuse.edu/shared-competencies/information-literacy-and-technological-agility/>)

CIS 565 Introduction to Artificial Neural Networks (3 Credits)*Engineering & Comp Sci*

Perceptrons and the Perceptron Convergence Theorem; non-linear optimization, gradient descent methods; neural net architecture, conjugate-gradient and recurrent networks; Hopfield networks, Kohonen's feature maps; non-neural clustering algorithms.

CIS 567 Knowledge Representation and Reasoning (3 Credits)*Engineering & Comp Sci*

Applications of mathematical methods to knowledge bases. Methods include nonclassical, fuzzy logic and statistical inference. Application topics include planning, temporal and physical reasoning, attitudes, the frame problem, preference, constraints, qualitative differential equations, situation theory.

CIS 570 Experience Credit (1-6 Credits)*Engineering & Comp Sci*

Participation in a discipline or subject related experience. Student must be evaluated by written or oral reports or an examination. Permission in advance with the consent of the department chairperson, instructor, and dean. Limited to those in good academic standing.

Repeatable

CIS 573 Computability Theory (3 Credits)*Engineering & Comp Sci***CIS 580 International Course (1-12 Credits)***Engineering & Comp Sci*

Offered through SUAbroad by educational institution outside the United States. Student registers for the course at the foreign institution and is graded according to that institution's practice. SUAbroad works with the S.U. academic department to assign the appropriate course level, title, and grade for the student's transcript.

Repeatable

CIS 581 Concurrent Programming (3 Credits)*Engineering & Comp Sci*

Processes, events, alphabets, and trace sets. Process equivalence. Divergence, dead-lock, fairness, and termination. Message channels, buffers, pipelines, trees, rings, grids, recursive nets. Mutual exclusion, semaphores, conditional critical regions, monitors, remote procedures. Programming exercises in Joyce.

CIS 590 Independent Study (1-6 Credits)*Engineering & Comp Sci*

Exploration of a problem, or problems, in depth. Individual independent study upon a plan submitted by the student. Admission by consent of supervising instructor(s) and the department.

Repeatable