

Computer Science

CS 1000 - Explorations in Computing

An introduction to the study of computing: fundamental concepts and skills; opportunities at Michigan Tech; career opportunities; social and ethical issues.

Credits: 1.0

Lec-Rec-Lab: (0-1-0)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following Major(s): Computer Engineering, Electrical Engineering, Computer Science, Computer Systems Science, Software Engineering; Must be enrolled in one of the following Class(es): Freshman

CS 1090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.

Credits: variable to 3.0; May be repeated

Semesters Offered: On Demand

Restrictions: Permission of instructor required

CS 1121 - Introduction to Computer Science I

Starting point of the computer science programs. A high-level, object-oriented programming language is introduced as a problem-solving tool. Topics include design, coding, documentation, debugging, and testing of programs. Programming assignments are given in both a closed lab setting and as homework.

Credits: 3.0

Lec-Rec-Lab: (0-2-2)

Semesters Offered: Fall, Spring, Summer

Pre-Requisite(s): MA 1032(C) or MA 1031(C)

CS 1122 - Introduction to Computer Science II

Continuation of CS 1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack and queue data structures, informal complexity-based algorithm and data structure choices, and recursion. Homework programming assignments are given. Not open to students with credit in CS1129.

Credits: 2.0

Lec-Rec-Lab: (0-2-0)

Semesters Offered: Fall, Spring, Summer

Pre-Requisite(s): CS 1121

CS 1129 - Introduction to Computer Science II in C++

Continuation of CS1121. Topics include data abstraction, class hierarchies and polymorphism, list, stack and queue data structures, informal complexity-based algorithm and data structure choices, and recursion. The C and C++ programming languages are presented and uses. Not open to students with credit in CS1122.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Restrictions: May not be enrolled in one of the following Major(s): Computer Engineering, Computer Science, Computer Systems Science, Software Engineering

Pre-Requisite(s): CS 1121

CS 1131 - Computer Science I

An alternative starting point of the computer science programs for students with some programming experience, combining material from CS1121 and CS1122, offered at an accelerated pace. Homework programming assignments are given.

Credits: 4.0

Lec-Rec-Lab: (0-4-0)

Semesters Offered: Fall, Spring

Restrictions: Permission of department required

Pre-Requisite(s): MA 1032 or MA 1031

CS 1721 - Object Oriented Design

Principles of object oriented design. Includes the software life cycle and unit testing. Students are required to design, unit test, implement, and final test a relatively large project.

Credits: 1.0

Lec-Rec-Lab: (0-1-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 1121 or CS 1131

CS 2090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.

Credits: variable to 3.0; May be repeated

Semesters Offered: On Demand

Restrictions: Permission of instructor required

CS 2141 - Software Development Methods Using C/C++

This course provides an accelerated coverage of C/C++ for Java programmers. Topics include object oriented design with UML, object oriented programming with C++, C/C++ memory model, differences between C and C++ use of libraries, and debugging with modern tools.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring, Summer

Pre-Requisite(s): CS 1721 and CS 2321

CS 2311 - Discrete Structures

Presents fundamental concepts in discrete structures that are used in computer science. Topics include sets, trees, graphs, functions, relations, recurrences, proof techniques, logic, combinatorics, and probability.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring, Summer

Pre-Requisite(s): (CS 1122 or CS 1131) and (MA 1160 or MA 1161 or MA 1135 or MA 1140)

CS 2321 - Data Structures

Presents fundamental concepts in data structures. Topics include ADTs (trees, priority queues, dictionaries and graphs) and their implementations, algorithm analysis, sorting and text processing. Programming projects are designed to apply these topics.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 1122

CS 3090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.

Credits: variable to 3.0; May be repeated

Semesters Offered: On Demand

Restrictions: Permission of instructor required

CS 3141 - Team Software Project

Introduction to the development of large software projects. Presents examples of software design, quality assurance techniques, and test-case design in conjunction with a significant team project involving design, test, and code documentation as well as user documentation. Other topics include teamwork, user interfaces, social and professional responsibility.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 2141 and CS 2311

CS 3311 - Formal Models of Computation

Introduction to the theory of languages and computation. Topics include regular languages and finite automata, context free languages and push-down automata, context free languages and push-down automata; Turing-acceptable languages and Turing machines, and their applications such as parsing.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 2311

CS 3411 - Systems Programming

Development of programs on modern operating systems. Topics include: scripting; compilation, linking, loading; libraries; process creation; file system access and protection; network programming; heterogeneity.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Pre-Requisite(s): CS 2141 and CS 3421

CS 3421 - Computer Organization

Introduction to the logical structure of computers, including the fundamentals of logic design, information storage and manipulation, control, input/output, and assembly language programming. Topics include a review of current hardware technology, combinational and sequential logic, arithmetic, datapaths, hard-wired control, interrupts, caches, virtual memory, and an introduction to pipelining.

Credits: 4.0

Lec-Rec-Lab: (0-4-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 2311

CS 3451 - Computer Administration

Administration of non-networked computers. Topics include: operating system installation; boot-up and shutdown; process management; account management; file systems; storage technology; backups; serial devices.

Credits: 4.0

Lec-Rec-Lab: (0-3-3)

Semesters Offered: Spring

Pre-Requisite(s): CS 3411 or CS 4411

CS 3621 - Computer Graphics: Elementary Geometric Objects and Processing

Topics include the creation, representation and manipulation of geometric objects. Surveys major paradigms of building shapes, including polyhedra, curved solids, curves, and surfaces. Covers classical computational geometry topics such as convex hulls and tessellations, algorithm robustness, and the impact of finite precision arithmetic on geometric computing. Applications discussed.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Pre-Requisite(s): MA 2160 and (MA 2330 or MA 2320 or MA 2321) and CS 2141

CS 3911 - Introduction to Numerical Methods with FORTRAN

Topics include floating point arithmetic, sources of numerical error, Taylor polynomials, solution of linear systems and nonlinear equations, interpolation, numerical integration, and numerical solution of differential equations. FORTRAN 90 topics include data types, control flow, arrays, procedures, pointers and dynamic data structures, I/O, and modules. Numerical algorithms will be coded.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Pre-Requisite(s): (MA 1160 or MA 1161) and (MA 2320(C) or MA 2321(C) or MA 2330(C)) and CS 2321

CS 4000 - Senior Seminar

Topics include ethical models, legal issues, privacy and security, social responsibility, professional responsibility and service, and the future of computing.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Pre-Requisite(s): CS 3141

CS 4090 - Special Topics in Computer Science

Special topics in computer science offered on occasion based on student and faculty demand and interest.

Credits: variable to 4.0; May be repeated

Semesters Offered: On Demand

Restrictions: Permission of instructor required

CS 4099 - Directed Study in Computer Science

Students study one or more special topics in computer science under the direction of one or more faculty members.

Credits: variable to 4.0; Repeatable to a Max of 6

Semesters Offered: Fall, Spring, Summer

Restrictions: Permission of instructor required

CS 4121 - Programming Languages

A discussion of the concepts underlying programming languages. Topics include programming paradigms; language criteria (including syntax, semantics, run-time behavior, and implementation issues); data, procedure, functional, and control abstraction; functional programming; and logic programming.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 1721 and CS 2321 and CS 3311

CS 4131 - Compiler Construction

Introduction to compilation techniques, including parsing, syntax-directed translation, run-time storage management, error recovery, code generation and optimization. Requires a significant project.

Credits: 4.0

Lec-Rec-Lab: (0-3-1)

Semesters Offered: Spring

Pre-Requisite(s): CS 3311 and CS 4411

CS 4311 - Introduction to Computation Theory

Provides deeper insight into the power of computing using various models of computation. Topics reviewed include proof techniques, finite automata, regular languages, pushdown automata, and context-free languages. Topics covered include Turing machines and their variants, the Halting Problem and decidability, Rice's theorem, computability, time complexity, reducibility, NP-completeness, space complexity, machine self reference, recursion and fixed point theorems, s-m-n theorem.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Pre-Requisite(s): CS 3311

CS 4321 - Introduction to Algorithms

Fundamental topics in algorithm design, analysis, and implementation. Analysis fundamentals include asymptotic notation, analysis of control structures, solving recurrences, and amortized analysis. Design and implementation topics include sorting, searching, and graph algorithms. Design paradigms include greedy algorithms, divide-and-conquer algorithms, and dynamic programming.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 2311 and CS 1721 and CS 2321

CS 4331 - Introduction to Parallel Programming

Introduction to developing parallel programs and solving problems using multiple concurrent processes. Shared memory and message passing paradigms are studied. Topics include conceptual models of parallel programming, basic analysis of parallel languages, parallel computer architecture, domain decomposition, and load balancing. Traditional computer science applications and numerical applications are also studied.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: On Demand

Pre-Requisite(s): CS 3421 and CS 4321

CS 4411 - Introduction to Operating Systems

Presents topics on program representation and execution, operating systems, process and threads, process scheduling, memory management, and file systems. Programming homework is required.

Credits: 4.0

Lec-Rec-Lab: (0-4-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 2141 and CS 3421

CS 4421 - Database Systems

Topics include goals of database management; data definition; data models; data normalization; data retrieval and manipulation; security, integrity, and privacy measures; file, data, and storage organization; object-database systems; and parallel and distributed databases. Surveys a number of general database systems and examines in detail at least one database system.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Spring

Pre-Requisite(s): CS 4411 or CS 4321

CS 4431 - Computer Architecture

Architecture of high-performance parallel computer systems. Introduces various forms of parallelism, such as multiple functional units, pipelining, multiprocessors, and processor arrays. Also covers interleaved memory, caching, and interconnection networks. Includes analytic and simulation models of architectural features that implement or support parallel processing.

Credits: 4.0

Lec-Rec-Lab: (0-3-3)

Semesters Offered: Fall

Pre-Requisite(s): CS 3421

CS 4451 - Network Administration

Administration of computer networks. Topics include: TCP/IP networking, mail, printing, configuring and building kernels, remote file systems, license management, managing web systems, common network administration services.

Credits: 4.0

Lec-Rec-Lab: (0-3-3)

Semesters Offered: Fall

Pre-Requisite(s): CS 3451 and CS 4461

CS 4461 - Computer Networks

Computer network architectures and protocols; design and implementation of datalink, network, and transport layer functions. Introduction to the Internet protocol suite and to network tools and programming.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Spring

Pre-Requisite(s): CS 4321 and CS 4411

CS 4471 - Computer and Network Security

Development of administration of secure software systems. Topics include principles of software development, practical cryptography, program security, operating system security, network security, database security, administration, legal and ethical issues.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Pre-Requisite(s): CS 4461 and MA 3203

CS 4481 - Computer and Network Performance Analysis

Analysis of the performance of computer systems. Topics include measurement techniques and tools, probability theory and statistics, experiment design and analysis, simulation, queuing models. Course includes a significant experimental component.

Credits: 4.0

Lec-Rec-Lab: (0-3-3)

Semesters Offered: Spring

Pre-Requisite(s): CS 4411 and MA 2720

CS 4611 - Computer Graphics: Foundations of Computer Graphics

Introduction to interactive computer graphics. Topics include graphics terminology, 3D viewing, 3D transformation, interactive techniques, use of graphics input devices, projections, modeling, lighting, texturing, evaluators, and graphics algorithms. Requires substantial programming homework.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Pre-Requisite(s): CS 2141

CS 4711 - Introduction to Software Engineering

Introduction to software engineering, the study of principled approaches to developing and maintaining software. Topics include software process models, project management and measurement, software life cycle, and design techniques.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Spring

Pre-Requisite(s): CS 3141

CS 4712 - Software Quality Assurance

This course focuses on the aspects of the software process most closely associated with ensuring product quality. Topics include requirements, elicitation and analysis, usability engineering, formal specification, verification, and validation.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Pre-Requisite(s): CS 3141

CS 4750 - Teaching Methods in Computer Science

Provides teaching methods, models, and experiences for teaching computer science in secondary schools. Topics discussed include teaching methods, learning, security and maintenance of equipment, professional journals, ethics, legal issues, diversity, and problem solving. Requires admission to the Teacher Education Program.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: On Demand

Restrictions: Permission of department required; May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Pre-Requisite(s): ED 4700

CS 4760 - Human-Computer Interactions

Principles of design and implementation of human-computer interfaces (HCI). Topics include: HCI design principles, tools and theory. Students receive direct experience with the design, implementation, and evaluation of human-machine interfaces and interactions.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Spring

Pre-Requisite(s): CS 3141

CS 4790 - Senior Design Project

A one semester course that requires students to apply the principles and techniques of software engineering covered in CS4711 and CS4712. Each student works as part of a team responsible for developing a quality software product.

Credits: 3.0

Lec-Rec-Lab: (0-1-4)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 4711 and CS 4712

CS 4791 - Senior Design Project I

The first semester of a two semester capstone project experience for students in the Software Engineering Degree Program. Given a major software project, students establish a team structure, determine an appropriate project schedule and scope, and begin development.

Credits: 3.0

Lec-Rec-Lab: (0-1-4)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 4711 and CS 4712(C)

CS 4792 - Senior Design Project 2

Students complete the project started in CS4791. The project is evaluated by the students, and a final presentation is made to the customer.

Credits: 3.0

Lec-Rec-Lab: (0-1-4)

Semesters Offered: Fall, Spring

Pre-Requisite(s): CS 4791

CS 4811 - Artificial Intelligence

Fundamental ideas and techniques that are used in the construction of AI problem solvers. Topics include knowledge representation, problem solving, heuristics, search heuristics, inference mechanisms, expert systems, and language understanding.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Spring

Pre-Requisite(s): CS 4121

Undergraduate Course Descriptions Effective Fall 2007

https://www.banweb.mtu.edu/pls/owa/stu_ctg_utils.p_online_all_courses_ug

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