

# COMPUTER SCIENCE (COMPSCI)

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## COMPSCI 101 Introduction to PC Application Software

3 cr. Undergraduate.

Introduction to software applications of the personal computer, including word processing, desktop publishing, spreadsheets, and databases.

**Prerequisites:** none.

**Course Rules:** Not open to CompSci students for cr.

**Last Taught:** Fall 2017, Fall 2016, Fall 2015, Fall 2014.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 111 Introduction to Unix

1 cr. Undergraduate.

Introduction to basic user skills for Unix operating systems. File system structure and access control. Basic user commands. Text editing.

Internet utilities.

**Prerequisites:** none.

**Last Taught:** Fall 2010, Fall 2009, Spring 2009, Fall 2008.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 112 Introduction to the Internet and the World Wide Web

3 cr. Undergraduate.

Survey of the technologies that enable common Internet applications and their security/privacy issues. Topics include HTTP, TCP/IP, DNS, email protocols, search engines, encryption, digital signatures and malware.

**Prerequisites:** none.

**Last Taught:** Fall 2012, Fall 2011, Fall 2009, Spring 2009.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 113 Introduction to Web Document Production

3 cr. Undergraduate.

An introduction to the computer languages used in World Wide Web documents. Design principles; techniques for form processing and inclusion of multimedia content.

**Prerequisites:** none.

**Last Taught:** Spring 2022, Summer 2021, Summer 2020, Spring 2019.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 132 Introduction to Computers and Programming

3 cr. Undergraduate.

How computers work; communicating with computers; introductory programming in a high-level language; elementary problem solving.

**Prerequisites:** Level 30 on Math Placement Test or Math 105(C).

**Last Taught:** Spring 2010, Spring 2009, Fall 2007, Fall 2006.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 140 Introduction to the Computer Science Laboratories

1 cr. Undergraduate.

Survey of the programming tools available in the Computer Science laboratory environment.

**Prerequisites:** CompSci 201(C)

**Last Taught:** Fall 2008, Spring 2008, Fall 2007, Spring 2007.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 150 Survey of Computer Science

3 cr. Undergraduate.

A survey of computer science. Topics include data storage and manipulation, operating systems and networks, algorithms and data structures, programming languages, artificial intelligence, and computability.

**Prerequisites:** none.

**Course Rules:** Counts as repeat of CompSci 299 with similar topic.

**General Education Requirements:** NS

**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 151 Introduction to Scientific Programming in Fortran

3 cr. Undergraduate.

Design and implementation of computer programs in fortran; stress will be placed on applications to different fields of science and engineering.

**Prerequisites:** Math 231(C) or 226(C).

**Last Taught:** Spring 2020, Spring 2018, Spring 2017, Spring 2016.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 160 Introduction to Computer Game Design and Programming

3 cr. Undergraduate.

An overview of computer game history; design concepts and considerations; implementation using a modern software development platform, such as GameMaker.

**Prerequisites:** none.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 202 Introductory Programming Using Python

3 cr. Undergraduate.

Programming in Python. Basic control structures including recursion. Basic and library data types. Problem solving with objects. Writing classes. Basic software development skills.

**Prerequisites:** Counts as repeat of CompSci 290 with similar topic. Pre-req: Level 30 on Math Placement Test, or a grade of C or better in Math 105 or 108.

**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 240 Introduction to Engineering Programming

3 cr. Undergraduate.

Problem solving with structured programming techniques using an engineering oriented programming language, such as MATLAB, including control structures, functions, arrays and matrices.

**Prerequisites:** Math Placement Level 40 or Math 116(P).

**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

## COMPSCI 241 C Programming for Embedded Systems

3 cr. Undergraduate.

Problem solving with structured programming techniques, using the C programming language; Topics include using arrays and pointers, memory management, unions, structures, files and low level IO, and process's and inter-process communication.

**Prerequisites:** a grade of C or better in COMPSCI 202(P), COMPSCI 240(P), or COMPSCI 250(P).

**Last Taught:** Spring 2022, Spring 2021, Fall 2020, Spring 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 250 Introductory Computer Programming**

3 cr. Undergraduate.

Problem solving with structured programming techniques using an object-oriented programming language, including control structures, functions, arrays, vectors, and pre-defined objects.

**Prerequisites:** Math Placement level 30.**Last Taught:** Summer 2022, Spring 2022, Fall 2021, Summer 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 251 Intermediate Computer Programming**

3 cr. Undergraduate.

Problem solving with objects. Writing classes. Use of standard data structures. Basic software development skills including text analysis tools, debugging, and configuration management.

**Prerequisites:** Math Placement Level 40 or Math 116(P) or Math 211(P); C or better in CompSci 250(201)(P).**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 290 Introductory Topics in Computer Science:**

1-3 cr. Undergraduate.

Lectures on new introductory material in computer science. Variable-content course.

**Prerequisites:** specific courses dependent on topic.**Course Rules:** May be retaken to max of 6 cr w/chg in topic.**Last Taught:** Fall 2017, Spring 2017, Summer 2016, Spring 2016.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 315 Introduction to Computer Organization and Assembly Language Programming**

3 cr. Undergraduate.

Introduction to number systems, arithmetic and Boolean operations. Digital computer organization. A specific computer system, assembly and machine language programming.

**Prerequisites:** Math Placement Level 40 or Math 116(P) or Math 211(P); CompSci 250(201)(P).**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 317 Discrete Information Structures**

3 cr. Undergraduate.

Introductory discussion of logic, proof techniques, sets, functions, relations, combinatorics, probability, and graphs.

**Prerequisites:** Math Placement Level of 35 or higher, or a grade of C or better in MATH 115(P), MATH 116(P) or MATH 211(P); and a grade of C or better in COMPSCI 250(P).**Last Taught:** Summer 2022, Spring 2022, Fall 2021, Spring 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 318 Topics in Discrete Mathematics**

3 cr. Undergraduate.

Number theory topics related to cryptography; discrete structures including graphs, partial orders, Latin squares and block designs; advanced counting techniques.

**Prerequisites:** a grade of C or better in CompSci 317(P) or Math 341(P).**Course Rules:** Jointly offered with & count as repeat of Math 318.**Last Taught:** Spring 2020, Spring 2019.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 337 System Programming**

3 cr. Undergraduate.

Introduction to the application programmer interface for a modern operating system. Overview of mechanisms for object oriented programming and memory management

**Prerequisites:** C or better in CompSci 251(P)**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 351 Data Structures and Algorithms**

3 cr. Undergraduate.

Programming in a structured, high-level, object-oriented language. Implementation of data structures and algorithms and their application.

**Prerequisites:** Math Placement Level 40 or Math 116(P) or 211(P); C or better in CompSci 251(P).**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 361 Introduction to Software Engineering**

3 cr. Undergraduate.

Introduction to core topics of software engineering including requirements analysis, object-oriented design, testing, and project management. Overview of ethical and social issues in computing.

**Prerequisites:** C or better in CompSci 351(P), satisfaction of GER English Composition competency req.**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 395 Social, Professional, and Ethical Issues**

3 cr. Undergraduate.

The social, professional and ethical issues that arise in the context of professional computing.

**Prerequisites:** soph st or cons instr.**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 411 Machine Learning and Applications**

3 cr. Undergraduate/Graduate.

Important topics and application in machine learning, including deep learning. Provides hands-on experience with machine learning software and libraries.

**Prerequisites:** completion of one of the following: COMPSCI 202(P), COMPSCI 241(P), or COMPSCI 250(P); or consent of instructor.**Course Rules:** COMPSCI 411 and ELECENG 411 are jointly offered and count as repeats of one another.**Last Taught:** Spring 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 411G Machine Learning and Applications**

3 cr. Undergraduate/Graduate.

Important topics and application in machine learning, including deep learning. Provides hands-on experience with machine learning software and libraries.

**Prerequisites:** completion of one of the following: COMPSCI 202(P), COMPSCI 241(P), or COMPSCI 250(P); or consent of instructor.**Course Rules:** COMPSCI 411 and ELECENG 411 are jointly offered and count as repeats of one another.**Last Taught:** Spring 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 417 Introduction to the Theory of Computation**

3 cr. Undergraduate/Graduate.

Introduction to formal languages, grammars and automata. Finite state automata, pushdown automata, turing machines. Regular, context-free recursive and recursively enumerable languages. Decidability.

**Prerequisites:** jr st; grade of C or better in CompSci 317(P) or grade of C or better in Math 341(P).

**Last Taught:** Spring 2021, Fall 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 417G Introduction to the Theory of Computation**

3 cr. Undergraduate/Graduate.

Introduction to formal languages, grammars and automata. Finite state automata, pushdown automata, turing machines. Regular, context-free recursive and recursively enumerable languages. Decidability.

**Prerequisites:** jr st; grade of C or better in CompSci 317(P) or grade of C or better in Math 341(P).

**Last Taught:** Spring 2021, Fall 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 422 Introduction to Artificial Intelligence**

3 cr. Undergraduate/Graduate.

Introduction to core techniques and broad survey of AI. Topics include: Lisp, heuristic search, knowledge representation, planning, vision, learning.

**Prerequisites:** jr st; C or better in CompSci 317(217)(P); & CompSci351(252)(P).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 422G Introduction to Artificial Intelligence**

3 cr. Undergraduate/Graduate.

Introduction to core techniques and broad survey of AI. Topics include: Lisp, heuristic search, knowledge representation, planning, vision, learning.

**Prerequisites:** jr st; C or better in CompSci 317(217)(P); & CompSci351(252)(P).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 423 Introduction to Natural Language Processing**

3 cr. Undergraduate/Graduate.

Introduction to natural language processing programs and an overview of the field. Topics include syntactic frameworks, parsing, semantics, interpretation, and applications.

**Prerequisites:** jr st; C or better in CompSci 351(P).

**Last Taught:** Fall 2021, Fall 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 423G Introduction to Natural Language Processing**

3 cr. Undergraduate/Graduate.

Introduction to natural language processing programs and an overview of the field. Topics include syntactic frameworks, parsing, semantics, interpretation, and applications.

**Prerequisites:** jr st; C or better in CompSci 351(P).

**Last Taught:** Fall 2021, Fall 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 425 Introduction to Data Mining**

3 cr. Undergraduate/Graduate.

Algorithms for uncovering useful information from data. Topics include data exploration, association rules, clustering, supervised learning, and mining structured data (e.g., sequences or graphs)

**Prerequisites:** jr st; CompSci 251(P), Math 221(P) or Math 232(P)

**Course Rules:** Counts as repeat of CompSci 657 with same topic.

**Last Taught:** Fall 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 425G Introduction to Data Mining**

3 cr. Undergraduate/Graduate.

Algorithms for uncovering useful information from data. Topics include data exploration, association rules, clustering, supervised learning, and mining structured data (e.g., sequences or graphs)

**Prerequisites:** jr st; CompSci 251(P), Math 221(P) or Math 232(P)

**Course Rules:** Counts as repeat of CompSci 657 with same topic.

**Last Taught:** Fall 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 431 Programming Languages Concepts**

3 cr. Undergraduate/Graduate.

Examination of abstract features of languages. Study of syntactic and semantic models; design and programming in procedural, object-oriented, functional and logical languages. Implementation methods.

**Prerequisites:** jr st; grade of C or better in CompSci 351(252)(P).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 431G Programming Languages Concepts**

3 cr. Undergraduate/Graduate.

Examination of abstract features of languages. Study of syntactic and semantic models; design and programming in procedural, object-oriented, functional and logical languages. Implementation methods.

**Prerequisites:** jr st; grade of C or better in CompSci 351(252)(P).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 443 Intelligent User Interfaces and Usability Assessment**

3 cr. Undergraduate.

Critical reading and discussion of scientific literature on the principles, methods, and current research in intelligent user interfaces including applications, architectures, and evaluation.

**Prerequisites:** jr st.

**Last Taught:** Spring 2022, Fall 2019.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 444 Introduction to Text Retrieval and Its Applications in Biomedicine**

3 cr. Undergraduate/Graduate.

Introduction to text retrieval, text classification and their biomedical applications; topics include: indexing, query processing, and document retrieval methods.

**Prerequisites:** jr st; CompSci 351(P) or HCA 442(P).

**Course Rules:** Jointly offered with & counts as repeat of HCA 444, CompSci 744, & HCA 744.

**Last Taught:** Fall 2021, Spring 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 444G Introduction to Text Retrieval and Its Applications in Biomedicine**

3 cr. Undergraduate/Graduate.

Introduction to text retrieval, text classification and their biomedical applications; topics include: indexing, query processing, and document retrieval methods.

**Prerequisites:** jr st; CompSci 351(P) or HCA 442(P).**Course Rules:** Jointly offered with & counts as repeat of HCA 444, CompSci 744, & HCA 744.**Last Taught:** Fall 2021, Spring 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 458 Computer Architecture**

3 cr. Undergraduate/Graduate.

Processor organization, memory hierarchy, pipelining, computer architectures exploiting instruction/data/thread level parallelism, warehouse scale computers.

**Prerequisites:** sophomore standing and a grade of C or better in COMPSCI 241(P) or COMPSCI 251(P).**Course Rules:** COMPSCI 458 and ELECENG 458 are jointly offered and count as repeats of one another.**Last Taught:** Summer 2022, Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 458G Computer Architecture**

3 cr. Undergraduate/Graduate.

Processor organization, memory hierarchy, pipelining, computer architectures exploiting instruction/data/thread level parallelism, warehouse scale computers.

**Prerequisites:** sophomore standing and a grade of C or better in COMPSCI 241(P) or COMPSCI 251(P).**Course Rules:** COMPSCI 458 and ELECENG 458 are jointly offered and count as repeats of one another.**Last Taught:** Summer 2022, Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 459 Fundamentals of Computer Graphics**

3 cr. Undergraduate/Graduate.

Scan-line algorithms, object representation, homogeneous coordinates, geometric transformations, viewing curves, illumination models, interactive input methods, texture mapping.

**Prerequisites:** jr st; Math 232(P); CompSci 251(P).**Last Taught:** Fall 2019.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 459G Fundamentals of Computer Graphics**

3 cr. Undergraduate/Graduate.

Scan-line algorithms, object representation, homogeneous coordinates, geometric transformations, viewing curves, illumination models, interactive input methods, texture mapping.

**Prerequisites:** jr st; Math 232(P); CompSci 251(P).**Last Taught:** Fall 2019.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 469 Introduction to Computer Security**

3 cr. Undergraduate/Graduate.

Privacy and authenticity of data and programs, communication, operating systems, network and database security, computer viruses, cryptography, private and public key cryptosystems, protocols.

**Prerequisites:** jr st; C or better in both CompSci 317(217)(P) & 251(P).**Last Taught:** Summer 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 469G Introduction to Computer Security**

3 cr. Undergraduate/Graduate.

Privacy and authenticity of data and programs, communication, operating systems, network and database security, computer viruses, cryptography, private and public key cryptosystems, protocols.

**Prerequisites:** jr st; C or better in both CompSci 317(217)(P) & 251(P).**Last Taught:** Summer 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 481 Server-side Internet Programming**

3 cr. Undergraduate/Graduate.

Introduces students to the concept of server-side programming and web applications development. Topics include dynamic web site development, session management, security, and relational databases.

**Prerequisites:** jr st; one of COMPSCI 113 (P), INFOST 320 (P), or ART 324 (P); C or better in COMPSCI 202(P), COMPSCI 361 (P) or COMPST 702(P).**Last Taught:** Fall 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 481G Server-side Internet Programming**

3 cr. Undergraduate/Graduate.

Introduces students to the concept of server-side programming and web applications development. Topics include dynamic web site development, session management, security, and relational databases.

**Prerequisites:** jr st; one of COMPSCI 113 (P), INFOST 320 (P), or ART 324 (P); C or better in COMPSCI 202(P), COMPSCI 361 (P) or COMPST 702(P).**Last Taught:** Fall 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 482 Rich Internet Applications**

3 cr. Undergraduate/Graduate.

Create standard-compliant web applications using client-side JavaScript and the Document Object Model.

**Prerequisites:** jr st; CompSci 361(P) or 481(P).**Last Taught:** Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 482G Rich Internet Applications**

3 cr. Undergraduate/Graduate.

Create standard-compliant web applications using client-side JavaScript and the Document Object Model.

**Prerequisites:** jr st; CompSci 361(P) or 481(P).**Last Taught:** Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 511 Symbolic Logic**

3 cr. Undergraduate/Graduate.

First-order predicate calculus; formal properties of theoretical systems; chief results of modern mathematical logic; advanced topics such as completeness and computability.

**Prerequisites:** jr st & either Philos 212(P) or 6 cr Math at the 300-level or above; or grad st.**Course Rules:** CompSci 511, Math 511, & Philos 511 are jointly offered & count as repeat of each other.**Last Taught:** Spring 2019, Spring 2017.**Current Offerings:** <https://catalog.uwm.edu/course-search/>



**COMPSCI 511G Symbolic Logic**

3 cr. Undergraduate/Graduate.

First-order predicate calculus; formal properties of theoretical systems; chief results of modern mathematical logic; advanced topics such as completeness and computability.

**Prerequisites:** jr st & either Philos 212(P) or 6 cr Math at the 300-level or above; or grad st.

**Course Rules:** CompSci 511, Math 511, & Philos 511 are jointly offered & count as repeat of each other.

**Last Taught:** Spring 2019, Spring 2017.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 520 Computer Networks**

3 cr. Undergraduate/Graduate.

Layered network architecture, protocols, data transmission, local area networks, multiplexing and switching, routing flow and congestion control, internetworking, wireless networking, network reliability and security.

**Prerequisites:** jr. st; CompSci 315(215)(P) or CompSci 458(P) or ElecEng 367(P).

**Last Taught:** Spring 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 520G Computer Networks**

3 cr. Undergraduate/Graduate.

Layered network architecture, protocols, data transmission, local area networks, multiplexing and switching, routing flow and congestion control, internetworking, wireless networking, network reliability and security.

**Prerequisites:** jr. st; CompSci 315(215)(P) or CompSci 458(P) or ElecEng 367(P).

**Last Taught:** Spring 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 522 Computer Game Design**

3 cr. Undergraduate/Graduate.

Design of rules, environments, rewards, and punishments, Game metrics, Including artificial intelligence in games, Puzzle generation, Automatic design, Humanness test, Influence maps, Diversity, Unpredictability.

**Prerequisites:** jr st; grade of C or better in CompSci 317(P).

**Course Rules:** Counts as repeat of CompSci 657 with similar topic.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 522G Computer Game Design**

3 cr. Undergraduate/Graduate.

Design of rules, environments, rewards, and punishments, Game metrics, Including artificial intelligence in games, Puzzle generation, Automatic design, Humanness test, Influence maps, Diversity, Unpredictability.

**Prerequisites:** jr st; grade of C or better in CompSci 317(P).

**Course Rules:** Counts as repeat of CompSci 657 with similar topic.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 530 Computer Networks Laboratory**

3 cr. Undergraduate/Graduate.

Experimentation with Wired and Wireless Computer Networks Design. Data Link and MAC Protocols, LANs, WANs, Routing, Transport Layer Protocols, Congestion Control, Network Security, Network Management.

**Prerequisites:** jr st; CompSci 520(P).

**Last Taught:** Spring 2017, Spring 2016.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 530G Computer Networks Laboratory**

3 cr. Undergraduate/Graduate.

Experimentation with Wired and Wireless Computer Networks Design. Data Link and MAC Protocols, LANs, WANs, Routing, Transport Layer Protocols, Congestion Control, Network Security, Network Management.

**Prerequisites:** jr st; CompSci 520(P).

**Last Taught:** Spring 2017, Spring 2016.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 535 Algorithm Design and Analysis**

3 cr. Undergraduate/Graduate.

Introduction to abstract data structures, analysis of time and space requirements of numerical and non-numerical algorithms methods for data manipulation.

**Prerequisites:** junior standing; MATH 211(P), MATH 213(P), MATH 221(P) or MATH 231(P); a grade of C or better in COMPSCI 351(P); and either COMPSCI 317(P) or both MATH 341(P) and MTHSTAT 361(P).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 535G Algorithm Design and Analysis**

3 cr. Undergraduate/Graduate.

Introduction to abstract data structures, analysis of time and space requirements of numerical and non-numerical algorithms methods for data manipulation.

**Prerequisites:** junior standing; MATH 211(P), MATH 213(P), MATH 221(P) or MATH 231(P); a grade of C or better in COMPSCI 351(P); and either COMPSCI 317(P) or both MATH 341(P) and MTHSTAT 361(P).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 536 Software Engineering**

3 cr. Undergraduate/Graduate.

Software engineering, the software life cycle, qualities of software; design, specification and verification of software, programming environments and tools, object oriented programming.

**Prerequisites:** jr st; grade of C or better in CompSci 251(P).

**Last Taught:** Spring 2012, Fall 2011.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 536G Software Engineering**

3 cr. Undergraduate/Graduate.

Software engineering, the software life cycle, qualities of software; design, specification and verification of software, programming environments and tools, object oriented programming.

**Prerequisites:** jr st; grade of C or better in CompSci 251(P).

**Last Taught:** Spring 2012, Fall 2011.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 537 Introduction to Operating Systems**

3 cr. Undergraduate/Graduate.

Process management including process creation, switching, multithreading, scheduling, communication and concurrency control; memory management including paging, segmentation and virtual memory; systems programming.

**Prerequisites:** jr st; CompSci 458(C) or ElecEng 458(C); CompSci 337(P).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 537G Introduction to Operating Systems**

3 cr. Undergraduate/Graduate.

Process management including process creation, switching, multithreading, scheduling, communication and concurrency control; memory management including paging, segmentation and virtual memory; systems programming.

**Prerequisites:** jr st; CompSci 458(C) or ElecEng 458(C); CompSci 337(P).**Last Taught:** Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 545 FPGA Embedded CPUs & Firmware Development**

3 cr. Undergraduate/Graduate.

Use of modern embedded system central processor units (CPUs) with integrated field-programmable gate arrays (FPGAs). Design and implementation of firmware for these devices.

**Prerequisites:** jr st; ElecEng 367(P) & 457(P).**Course Rules:** Jointly offered with & counts as repeat of ElecEng 545.**Last Taught:** Fall 2014.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 545G FPGA Embedded CPUs & Firmware Development**

3 cr. Undergraduate/Graduate.

Use of modern embedded system central processor units (CPUs) with integrated field-programmable gate arrays (FPGAs). Design and implementation of firmware for these devices.

**Prerequisites:** jr st; ElecEng 367(P) & 457(P).**Course Rules:** Jointly offered with & counts as repeat of ElecEng 545.**Last Taught:** Fall 2014.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 547 User-Centered Interaction Design**

3 cr. Undergraduate/Graduate.

Introduction of human-computer interaction theories and design processes. Emphasis is on applied user experience (UX) design.

**Prerequisites:** sr st.**Course Rules:** Jointly offered with & counts as repeat of InfoSt 547.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 547G User-Centered Interaction Design**

3 cr. Undergraduate/Graduate.

Introduction of human-computer interaction theories and design processes. Emphasis is on applied user experience (UX) design.

**Prerequisites:** sr st.**Course Rules:** Jointly offered with & counts as repeat of InfoSt 547.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 552 Advanced Object-Oriented Programming**

3 cr. Undergraduate/Graduate.

An advanced course in object-oriented programming. Abstraction; single and multiple inheritance; dynamic binding of functions; polymorphic types and operators; survey of object-oriented techniques.

**Prerequisites:** jr st; C or better in both CompSci 351(P) & 361(P).**Last Taught:** Fall 2019.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 552G Advanced Object-Oriented Programming**

3 cr. Undergraduate/Graduate.

An advanced course in object-oriented programming. Abstraction; single and multiple inheritance; dynamic binding of functions; polymorphic types and operators; survey of object-oriented techniques.

**Prerequisites:** jr st; C or better in both CompSci 351(P) & 361(P).**Last Taught:** Fall 2019.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 557 Introduction to Database Systems**

3 cr. Undergraduate/Graduate.

General database system concepts. Physical data organization. Data models and database systems. Database design theory. Query optimization. Transaction management. Logic and database.

**Prerequisites:** junior standing and COMPSCI 251(P) or equivalent.**Last Taught:** Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 557G Introduction to Database Systems**

3 cr. Undergraduate/Graduate.

General database system concepts. Physical data organization. Data models and database systems. Database design theory. Query optimization. Transaction management. Logic and database.

**Prerequisites:** junior standing and COMPSCI 251(P) or equivalent.**Last Taught:** Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 581 Web Languages and Standards**

3 cr. Undergraduate.

Introduction to languages and standards for Web applications, including markup, schema, style, transformation, and metadata languages. Document programming interfaces. Emphasis on programming language principles.

**Prerequisites:** jr st; CompSci 431(P) & 417(R).**Last Taught:** Spring 2009, Spring 2007, Fall 2005, Fall 2004.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 594 Capstone Project Preparation**

1 cr. Undergraduate.

Student teams will develop requirements and functionality specifications for their capstone projects and conduct the necessary research on the prior art and technologies to be used.

**Prerequisites:** senior standing.**Course Rules:** Meant to be taken in the semester immediately prior to the one in which the student will take COMPSCI 595.**Last Taught:** Spring 2022, Fall 2021.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 595 Capstone Project**

3 cr. Undergraduate.

Students will integrate their knowledge of the undergraduate computer science curriculum by implementing a significant computer science team project.

**Prerequisites:** senior standing, COMPSCI 351(P), COMPSCI 361(P), COMPSCI 594(P) and credit in at least 6 credits of 400 or higher COMPSCI or ELECENG courses.**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 599 Senior Thesis**

3 cr. Undergraduate.

Independent scholarly research in Computer Science supervised by a faculty member.

**Prerequisites:** sr st & cons instr.**Last Taught:** Fall 2021, Spring 2019, Spring 2018, Summer 2014.**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 620 Undergraduate Seminar in Algorithms:**

1 cr. Undergraduate.

Variable topics seminar in algorithms.

**Prerequisites:** COMPSCI 535(P).

**Course Rules:** Retakable to 6 cr max with change in topic.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 654 Introduction to Compilers**

3 cr. Undergraduate.

Fundamentals of compiler construction for modern programming languages. Syntax analysis, table organization, storage administration, semantic routines and code generation

**Prerequisites:** jr st; CompSci 431(P), 655(C).

**Last Taught:** Spring 2022, Spring 2020, Spring 2018, Spring 2017.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 655 Compiler Implementation Laboratory**

3 cr. Undergraduate/Graduate.

Implementation of compiler phases: scanner, parser, semantic analysis; code generation and optimization.

**Prerequisites:** Prereq. jr st, CompSci 431(P); 654(C) or 754(C).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 655G Compiler Implementation Laboratory**

3 cr. Undergraduate/Graduate.

Implementation of compiler phases: scanner, parser, semantic analysis; code generation and optimization.

**Prerequisites:** Prereq. jr st, CompSci 431(P); 654(C) or 754(C).

**Last Taught:** Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 657 Topics in Computer Science:**

1-4 cr. Undergraduate/Graduate.

Lectures on recent advances in computer science. Specific credits and any additional prerequisites will be announced in Schedule of Classes whenever course is offered.

**Prerequisites:** jr st.

**Course Rules:** May be retaken w/chg in topic to 9 cr max.

**Last Taught:** Spring 2022, Fall 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 657G Topics in Computer Science:**

1-4 cr. Undergraduate/Graduate.

Lectures on recent advances in computer science. Specific credits and any additional prerequisites will be announced in Schedule of Classes whenever course is offered.

**Prerequisites:** jr st.

**Course Rules:** May be retaken w/chg in topic to 9 cr max.

**Last Taught:** Spring 2022, Fall 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 658 Topics in Applied Computing:**

1-4 cr. Undergraduate.

Lectures on recent advances in applied computing. Specific credits and any additional prerequisites will be announced in Schedule of Classes whenever course is offered.

**Prerequisites:** jr st.

**Course Rules:** May be retaken w/chg in topic.

**Last Taught:** Fall 2021, Spring 2021, Fall 2020, Spring 2020.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 699 Independent Study**

1-3 cr. Undergraduate/Graduate.

**Prerequisites:** jr st; cons instr.

**Course Rules:** May be retaken to max of 6 cr by undergraduates.

**Last Taught:** Summer 2022, Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 699G Independent Study**

1-3 cr. Undergraduate/Graduate.

**Prerequisites:** jr st; cons instr.

**Course Rules:** May be retaken to max of 6 cr by undergraduates.

**Last Taught:** Summer 2022, Spring 2022.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 700 CEAS Graduate Seminar**

1-3 cr. Graduate.

Seminar in professional ethics, oral and written communication, contemporary social issues, career development, time management, and laboratory safety.

**Prerequisites:** grad st

**Course Rules:** Civ Eng 700, CompSci 700, ElecEng 700, Ind Eng 700,

MatlEng 700 & MechEng 700 are jointly offered and count as repeats of one another

**Last Taught:** Fall 2020, Spring 2020, Fall 2019, Spring 2019.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 704 Analysis of Algorithms**

3 cr. Graduate.

Introduction to concrete complexity theory and efficient algorithms. Fast data structure and graph algorithms, matrix multiplication, algebraic and numeric algorithms, reducibilities and np-completeness. Exponential and non-elementary lower bounds.

**Prerequisites:** grad st; CompSci 217(P) & 535(P).

**Last Taught:** Fall 2021, Fall 2020, Fall 2019, Spring 2019.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 708 Scientific Computing**

3 cr. Graduate.

Fundamental algorithms and practical issues of scientific computing, including Monte Carlo simulations, data fitting, fast Fourier transform, optimization, numerical integration & differentiation, parallel computing, selected biomedical applications.

**Prerequisites:** grad st

**Last Taught:** Spring 2020, Fall 2018, Spring 2017, Spring 2016.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 710 Artificial Intelligence**

3 cr. Graduate.

AI programming, search techniques game playing, knowledge representation, knowledge acquisition, expert systems, selected topics from learning. Natural language understanding, vision and robotics.

**Prerequisites:** grad st; CompSci 252(P) & 535(P).

**Course Rules:** Not open to students who have cr in ElecEng 710, which is identical to CompSci 710.

**Last Taught:** Spring 2021, Fall 2019, Spring 2018, Spring 2016.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 711 Introduction to Machine Learning**

3 cr. Graduate.

Introduction to machine learning techniques and applications, including optimal classification, regression, support vector machines, boosting, deep learning, and clustering.

**Prerequisites:** grad st**Course Rules:** ElecEng 711 & CompSci 711 are jointly offered; they count as repeats of one another.**Last Taught:** Spring 2022, Spring 2021, Spring 2020, Spring 2019.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 712 Image Processing**

3 cr. Graduate.

This course covers the materials required to process and enhance photographic images, remote sensor multispectral scanner data and others. Topics include transform techniques, recorders, discriminate function, and associated hardware.

**Prerequisites:** grad st**Last Taught:** Fall 2021, Fall 2020, Fall 2019, Fall 2018.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 714 Computational Geometry**

3 cr. Graduate.

Special data structures and algorithmic techniques for representing and manipulating geometric objects, such as points, lines and polygons. Applications to vlsi design and robotics.

**Prerequisites:** grad st; CompSci 535(P).**Last Taught:** Fall 2012, Spring 2010, Fall 2006, Fall 2004.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 715 Programming for Machine Learning**

3 cr. Graduate.

Introduction of Python for machine learning. including Python constructs, imperative, functional, and object-oriented programming using Python, Python's concurrency models, and its applications in machine learning and scientific computing.

**Prerequisites:** graduate standing.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 718 Advanced Computer Graphics: Modeling and Animation**

3 cr. Graduate.

Advanced graphics topics on mesh processing, illumination models, ray-tracing, and volumetric data visualization; popular animation approaches such as keyframes, particles, fluids and rigid bodies.

**Prerequisites:** grad st.**Last Taught:** Spring 2021, Spring 2019, Spring 2018, Spring 2017.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 720 Computational Models of Decision Making**

3 cr. Graduate.

Theoretical foundations and practical problems of formulating and constructing computational models of decision making.

**Prerequisites:** basic course in Probability or Statistics.**Last Taught:** Fall 2021, Fall 2020, Fall 2019, Fall 2018.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 722 Artificial Intelligence Planning Techniques**

3 cr. Graduate.

Algorithms and representations for classical and more expressive planning, search control techniques, study and comparison of a variety of planners, applications of planning.

**Prerequisites:** grad st; Comp Sci 535(P).**Last Taught:** Fall 2011, Spring 2008, Spring 2006, Spring 2005.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 723 Natural Language Processing**

3 cr. Graduate.

Principles and problems of natural language processing with emphasis on recent advances and open problems. Topics: lexicons, parsing, interpretation, discourse structure, generation, and collaborative interfaces.

**Prerequisites:** grad st; CompSci 422(P) or 710(P).**Course Rules:** Not open to students with cr in CompSci 423.**Last Taught:** Fall 2021, Fall 2020, Spring 2019, Fall 2017.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 724 Distributed Algorithms**

3 cr. Graduate.

Identification of canonical problems in distributed computing, design and analysis of algorithms to solve these problems. Formal proof techniques and impossibility results.

**Prerequisites:** grad st; CompSci 517(P), 535(P), or 523(P).**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 725 Robot Motion Planning**

3 cr. Graduate.

Configuration space, C-obstacles, sampling-based algorithms, potential fields, coverage, hierarchical motion planning, human control, relaxation, moving or deformable obstacles, multirobot motion planning, metrics, outdoor planning.

**Prerequisites:** grad st**Last Taught:** Spring 2022, Spring 2021, Spring 2020, Spring 2019.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 729 Real-Time Operating Systems**

3 cr. Graduate.

Fundamentals of real-time operating systems with emphasis on scheduling and resource management.

**Prerequisites:** grad st**Last Taught:** Spring 2017, Spring 2016, Spring 2015.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 730 Advanced Computer Networks**

3 cr. Graduate.

Network architecture, protocols, routing, congestion control, traffic management, ATM, optical networks, TCP/IP, LANs, WANs, QOS, wireless and mobile networks, mobility management, security, multimedia, network management.

**Prerequisites:** CompSci 520 (P).**Last Taught:** Fall 2019, Fall 2014, Fall 2010, Fall 2009.**Current Offerings:** <https://catalog.uwm.edu/course-search/>



**COMPSCI 732 Type Systems for Programming Languages**

3 cr. Graduate.

Lambda calculus, simple types, record types, subtypes, polymorphic types, type reconstruction, universal types, bounded quantification, higher-order types.

**Prerequisites:** graduate standing and COMPSCI 431(P).**Last Taught:** Fall 2021, Fall 2019, Fall 2016, Spring 2015.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 737 Software Project Management**

3 cr. Graduate.

Concepts and techniques for management of large software projects. Life cycle models; team organization; cost estimation and budgeting; schedule and risk management; software metrics.

**Prerequisites:** grad st; CompSci 361(P) or equivalent**Last Taught:** Spring 2015, Spring 2013.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 738 Program Analysis for Software Engineering**

3 cr. Graduate.

Static techniques for determining run-time properties of a program: data-flow analysis, abstract interpretation.

**Prerequisites:** grad st.**Last Taught:** Spring 2021, Spring 2018, Spring 2017, Spring 2009.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 743 Intelligent User Interfaces**

3 cr. Graduate.

Principles, methods, and current research in intelligent user interfaces including applications, architectures, knowledge representation, and evaluation.

**Prerequisites:** grad st.**Last Taught:** Spring 2022, Fall 2019, Fall 2018, Fall 2017.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 744 Text Retrieval and Its Applications in Biomedicine**

3 cr. Graduate.

Fundamental issues and current research in text retrieval, text classification and their biomedical applications; Programming and use of indexing, query processing, and document retrieval methods.

**Prerequisites:** grad st; COMPSCI 351(P) or HCA 442 (P)**Course Rules:** Not open to students who have cr in HCA 744, COMPSCI 444, or HCA 444.**Last Taught:** Fall 2021, Spring 2020, Fall 2018, Spring 2015.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 747 Principles & Practices of User Interface Design**

3 cr. Graduate.

Principles and practices of user interface design for desktop, web, and mobile applications: interaction principles; UI design elements; user-centered design process and practices.

**Prerequisites:** grad st.**Last Taught:** Spring 2016, Spring 2014, Spring 2012, Fall 2009.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 754 Compiler Construction and Theory**

3 cr. Graduate.

Fundamentals of compiler construction for modern programming languages. Syntax analysis, table organization, storage administration, semantic routines and code generation.

**Prerequisites:** grad st.**Course Rules:** Not open to those who have cr in CompSci 654.**Last Taught:** Spring 2022, Spring 2020, Spring 2018, Spring 2016.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 755 Information and Coding Theory**

3 cr. Graduate.

Information measures, entropy, source coding, Shannon's theorems, channel capacity, error correcting codes, linear codes, convolutional codes, arithmetic codes, encoding and decoding algorithms.

**Prerequisites:** grad st.**Last Taught:** Fall 2019, Fall 2018, Fall 2017, Fall 2016.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 757 Data Base Organization and File Structure**

3 cr. Graduate.

Introduction to automatic information organization and retrieval. Dictionary construction and operation, statistical and syntactic operations, performance evaluation of retrieval systems, design of query languages, models of database systems, database security.

**Prerequisites:** grad st; CompSci 217(P) & 535(P).**Last Taught:** Spring 2014, Fall 2011, Spring 2010, Spring 2009.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 758 Advanced Computer Architecture**

3 cr. Graduate.

Advanced topics in computer architecture including pipeline processing, multiple and parallel processing systems, performance enhancement issues and vlsi computing structures.

**Prerequisites:** grad st; CompSci 458(NP) or ElecEng 458(NP).**Course Rules:** Not open to students who have cr in ElecEng 758, which is identical to CompSci 758.**Last Taught:** Fall 2013, Fall 1997, Fall 1995, Spring 1994.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 759 Data Security**

3 cr. Graduate.

Protection of data in computer and communication systems, cryptography, classical one key and public key cryptosystems, database protection, operating system security.

**Prerequisites:** graduate standing and COMPSCI 317(P).**Last Taught:** Spring 2019, Spring 2018, Spring 2017, Spring 2016.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 760 Computer Systems Performance Evaluation**

3 cr. Graduate.

Performance measurement and tools, workload characterization, markov models, queueing theory, simulation, benchmarks, data analysis, parallel systems performance analysis.

**Prerequisites:** grad st; CompSci 458(P) or ElecEng 458(P).**Course Rules:** Not open to students who have cr in ElecEng 760, which is the same as CompSci 760.**Last Taught:** Fall 2017, Fall 2016, Fall 2014, Spring 2013.**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 761 Software Testing and Verification**

3 cr. Graduate.

Software testing techniques: test case generation, test oracles, regression testing, structural testing, test coverage, mutation testing, and model-based testing. Testing for object-oriented and distributed software. Security testing.

**Prerequisites:** grad st; CompSci 361(P) or equivalent**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 762 Fault-Tolerant Computing**

3 cr. Graduate.

Faults in digital circuits, fault detection, fault location, system reconfiguration or repair, system recovery, design for testability, self-checking circuits, fault-tolerant interconnection networks, systems level fault-diagnosis, fault-tolerant software.

**Prerequisites:** grad st; ElecEng 354(P).**Course Rules:** Not open to students with cr for ElecEng 762.**Last Taught:** Spring 2002, Spring 2000, Spring 1997, Spring 1995.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 780 Multimedia Systems**

3 cr. Graduate.

Survey of principles and applications of multimedia computer systems. Media fundamentals. Networking, architecture, software engineering, and user interface issues.

**Prerequisites:** CompSci 537(P).**Last Taught:** Spring 2015, Spring 2010, Spring 2005, Fall 2001.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 790 Advanced Topics in Computer Science:**

3 cr. Graduate.

Discussion of special advanced topics in theoretical as well as applied areas in computer science.

**Prerequisites:** grad st; add'l prereqs depending on topic.**Course Rules:** Retakable w/chg in topic to 9 cr max. Specific topics may be jointly-offered w/Philos.**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 805 Randomized Algorithms; Pseudorandom Numbers**

3 cr. Graduate.

Probabilistic algorithms in number theory, combinatorics, graph theory, and computational geometry. Sorting and searching. Applications to parallel computation. Interactive proofs. Derandomization of algorithms.

**Prerequisites:** CompSci 704(P) CompSci 523(R).**Last Taught:** Fall 2013, Fall 2010, Spring 2007, Fall 2005.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 810 Knowledge Representation**

3 cr. Graduate.

Study of the design and properties of formalisms for representing knowledge in computational systems. Topics include: first-order logic, nonmonotonic logic, uncertainty, time, space, beliefs, plans.

**Prerequisites:** grad st; CompSci 710(P).**Last Taught:** Fall 2014, Spring 2011.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 811 Advanced Machine Learning**

3 cr. Graduate.

Advanced topics and applications in machine learning, including deep learning, recurrent neural networks, EM algorithm and clustering, reinforcement learning, Markov models and MCMC, and variational inference.

**Prerequisites:** ELECENG 711(P) or ELECENG 420(P) and

COMPSCI 411(P); or consent of instructor.

**Course Rules:** COMPSCI 811 and ELECENG 811 are jointly offered and count as repeats of one another; they also count as a repeat of COMPSCI 890 or ELECENG 890 with similar topic 'Advanced Machine Learning'.**Last Taught:** Spring 2022.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 854 Advanced Compiler Techniques**

3 cr. Graduate.

Details of compiler construction: syntax theory, attribute grammars, implementing advanced language features, optimization

**Prerequisites:** grad st; CompSci 654(P) or 754(P)**Last Taught:** Fall 2018, Fall 2015, Fall 2010.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 859 Advanced Cryptography and Security Protocols**

3 cr. Graduate.

Elliptic curve cryptography, AES, cryptanalysis, secret sharing, zero knowledge proofs, provable security.

**Prerequisites:** grad st; CompSci 469(P) & CompSci 535(P), or CompSci 759(P)**Last Taught:** Spring 2012, Fall 2008.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 870 Medical Informatics Seminar**

1 cr. Graduate.

Presentations by medical informatics affiliated faculty and invited speakers. Graduate students may present their work or published research from recent medical informatics journals or conferences.

**Prerequisites:** grad st.**Course Rules:** Meets once every two weeks for 100 minutes.**Last Taught:** Spring 2022, Fall 2021, Spring 2021, Fall 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 880 Bioengineering Seminar**

1 cr. Graduate.

Presentations by bioengineering affiliated faculty, invited speakers, and graduate students.

**Prerequisites:** grad st**Course Rules:** MechEng 880, ElecEng 880, CompSci 880, MatlEng 880, IndEng 880 & Civ Eng 880 are jointly offered and count as repeats of one another. May be repeated to 3 cr. max.**Last Taught:** Spring 2015, Fall 2012.**Current Offerings:** <https://catalog.uwm.edu/course-search/>**COMPSCI 888 Candidate for Degree**

0 cr. Graduate.

Available for graduate students who must meet minimum credit load requirement.

**Prerequisites:** graduate standing.**Course Rules:** Fee for 1 cr assessed; unit does not count towards credit load for Fin Aid. Repeatable. Satisfactory/Unsatisfactory only.**Last Taught:** Spring 2022, Fall 2021, Summer 2020, Spring 2020.**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 990 Masters Thesis**

1-9 cr. Graduate.

**Prerequisites:** grad st; cons instr.

**Last Taught:** Summer 2022, Spring 2022, Fall 2021, Summer 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 995 Master's Capstone Project**

1-3 cr. Graduate.

Independent project supervised by student's adviser

**Prerequisites:** grad st; cons instr & grad prog comm.

**Last Taught:** Summer 2022, Spring 2022, Fall 2021, Spring 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 998 Doctoral Thesis**

1-12 cr. Graduate.

**Prerequisites:** grad st; cons instr & grad prog committee.

**Last Taught:** Summer 2022, Spring 2022, Fall 2021, Summer 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>

**COMPSCI 999 Advanced Independent Study**

1-3 cr. Graduate.

**Prerequisites:** grad st; cons instr & grad prog comm.

**Last Taught:** Summer 2022, Spring 2022, Fall 2021, Summer 2021.

**Current Offerings:** <https://catalog.uwm.edu/course-search/>