

CYBER SYSTEMS (CYBR)

CYBR 100 – Programming Logic, Design and Practice 3 credit hours

This course will teach the fundamentals of the software development with emphasis on program logic and design process. This course does not teach a particular programming language but rather emphasizes on problem solving techniques, while this course discusses the basic programming tools available in most programming languages.

CYBR 101 – Computer Science I: Python for Analytics 3 credit hours

A gentle first course in problem solving and software development; including logic, data storage and manipulation, data types, assignment statements, basic input/output, selection control, repetition control, subprograms, data file input/output, simple GUIs, one dimensional arrays and rudimentary software engineering techniques. Students complete programming projects using Python. Good programming techniques, program clarity, style, and effective documentation are emphasized through practice in designing, coding, and debugging programs. Intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in analyzing data in business, science, mathematical, and other problems. It is designed to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python programming language. Three hours lecture, two hours laboratory each week.
Prerequisite: Completion of or concurrent enrollment in MATH 101 or higher

CYBR 102 – Computer Science I: C for Security 3 credit hours

A rigorous first course in problem solving and software development that demonstrates the power of C as a high and low level language. Includes logic, data storage and manipulation, data types, assignment statements, basic input/output, selection control, repetition control, subprograms, parameter passage, scope of identifiers, data file input/output, one dimensional arrays and rudimentary software engineering techniques. Students complete programming projects using C programming. Secure programming techniques, program clarity, style, and effective documentation are emphasized through practice in designing, coding, and debugging programs. Intended for students interested in improving their security or engineering related problem-solving abilities through the use of software development, but no programming experience is necessary. Laboratory assignments develop mastery of the C programming language and a basic understanding of modern secure software development practices. Two hours lecture, two hours laboratory each week.

Prerequisite: Completion of or concurrent enrollment in MATH 102 or ACT Math score of 22 or above or Math placement into MATH 103 or above.

CYBR 105 – Cyber Systems Freshmen: Professional Practice 2 credit hours

This course is intended to offer all CYBR Freshmen an opportunity to have an orientation to computing educational programs and pathways to professional practice. It will provide an overall orientation to all incoming freshmen about different degree programs, courses, interconnecting elements of the degree programs that connects across our different areas of comprehensive CS, Applied CS, IT, Networking, SW, CSO, and BI. In discussing Cyber Systems department program offerings, we will orient students about how departmental programs relate to each other i.e., common thread/synergies across, how students will progress from Freshman year to Senior year as well graduating from our Department which specific degree programs leading to different trajectories of career pathways.

CYBR 106 – Computational and Inferential Thinking 3 credit hours

A gentle introduction to data science. How can one understand the underlying phenomenon generating data across a wide variety of domains to make predictions, and improve decisions? This course focuses on building skills in inferential and computational thinking, guided by the practical questions we seek to answer. The course teaches critical concepts and skills in computer programming and statistical inference, in conjunction with hands-on analysis of real-world datasets such as economic data, document collections, health care data, geographical data, and social networks. We will also consider social and ethical issues in data analysis such as privacy and design.

CYBR 126 – First Year Seminar 1 credit hour

The First-Year Seminar provides students with a multidisciplinary experience in which they approach an issue or problem from the perspective of three different academic differences. The First-Year Seminar will consist of three 1-credit hour courses taken as co-requisites in a single semester. The successful completion of all three courses satisfies the General Studies LOPER 1 course requirement. Students may take the First-Year Seminar in any discipline, irrespective of their major or minor. Students admitted as readmit students or transfer students who transfer 18 or more hours of General Studies credit to UNK are exempt from taking a LOPER 1 course.

CYBR 140 – The Internet Explained 3 credit hours

This course is a great introduction to how the Internet works. Topics include history of telephony to the Internet, networking, wireless, cybersecurity and how these technologies are integrated into the daily lives of individuals. The course assumes no previous knowledge of the field, and can be used by all students seeking a background in fundamental networking and systems concepts. This course provides basic information needed for the student going on to pursue a career in the information technology fields. It also provides a technological foundation for students pursuing any career. With the prevalence of technology, understanding and becoming proficient with the basic terminology and concepts is a must for any student.

CYBR 150 – Computer Science II: Object Oriented Programming 3 credit hours

Object-Oriented (OO) programming concepts and principles, including an introduction to some basic data structures. Comprehensive study of an OO programming language with a variety of programming applications. An appropriate state-of-the-art language will be used.
Prerequisite: Grade of C-minus or better in CYBR 101

CYBR 151 – Cyber Programming Environment: Linux 1 credit hour

All first-year Cyber students should take this course in their first semester. This hands-on lab course focuses on the programming environment tools and systems needed not only in the Cyber field but in most Cyber coursework.

CYBR 158 – Introduction to Information Security 3 credit hours

This course provides the basic concepts and principles of information security and the fundamental approaches to secure and protect computers, networks and stored data. It also provides the students with the knowledge and tools to make the computers and related technology equipment-tablets, laptops, smartphones, and wireless networks-secure. The main topics include: security basics; security management and risk assessment; software security; network authentication and secure network applications; mobile security; legal and ethical issues; and privacy. Each topic contains Hands-On projects that cover making computers secure, as well as how to use and configure security hardware and software.

Prerequisite: Completion of or concurrent enrollment in CYBR 101

CYBR 159 – Data, Ethics, and Society 3 credit hours

This course offers critical examination of the role of data in society as well as reviews of data practices in research, education, business and government including nonprofits. Through case studies, students will learn to examine ethical questions related to data in society and explore topics include the Internet of things, wearables, learning analytics, and black-box algorithms. In this course, students will be introduced to the ethical, legal and privacy issues surrounding the collection and use of big data as well as offers illustration how lack of awareness can impact societies at large.

CYBR 180 – Discrete Structures 3 credit hours

The study of mathematical topics and data structures necessary for a successful program of study in Computer Science. Topics include set theory, Boolean algebra, propositional calculus, logic circuits and finite state machines.

Prerequisite: CYBR 101.

Corequisite: Completion of or concurrent enrollment in MATH 115 or MATH 123.

CYBR 182 – Software Productivity Tools 3 credit hours

This lab course addresses competency and applications of computer skills. Software covered includes: operating systems and environments, word processing, spreadsheet, databases and cloud-based solutions.

CYBR 190 – Data Analytics Mathematical Modeling 3 credit hours

This course is designed to cover fundamental IT enabled models and their application in data analytics. Some areas to be covered include: systems of equations and inequalities; sequences, inductions, and the binomial theorem; counting and probability; basic statistics; simulation; data tables and what-if analysis; and enhancing decision-making using Solver. Prior completion of LOPER 4 - Mathematics, Statistics and Quantitative Reasoning course is highly recommended.

CYBR 199 – Current Issues in Cyber Systems 1-3 credit hours

A course designed to enable students to become knowledgeable of recent trends and issues in computer science and information technology. The course format varies depending on subject matter, instructor and student needs.

Total Credits Allowed: 6.00

CYBR 280H – Special Topics 3 credit hours

A General Studies course for Honors students. Interdisciplinary course that examines the connections between disciplines.

CYBR 300 – Operating Systems 3 credit hours

Introduction to modern operating system concepts and design. Topics will include: Processes, semaphores, monitors, concurrent process management, virtual memory, file systems, scheduling algorithms, deadlocks and protection, I/O control interrupt handling, client-server model, remote procedure call and threads.

Prerequisite: CYBR 330

CYBR 301 – Computer Organization 3 credit hours

A study of computer organization and Assembly language. Topics include basic assembly instructions, logic design, addressing modes and instruction sets, data path, memory hierarchy. Students will gain hands on experience in programming in x86 and ARM assembly.

Prerequisite: CYBR 300

Additional Course Fee Required

CYBR 302 – Principles of Management Information Systems 3 credit hours

The course provides an introduction and overview to the field of management of information systems (MIS). This course is designed to familiarize students with the critical roles of information and information systems in support of organizational operations, decision-making processes, quality management, and strategic activities. It also covers management of information systems functions and professionals, as well as relevant global, ethical, societal and legal/regulatory issues. Focus is placed on the impact of rapidly changing technologies, such as the Internet, on organizations leading to new paradigms, like e-commerce and business-to-business applications, and the subsequent reengineering of organizations.

CYBR 304 – Foundation of Computational Mathematics 3 credit hours

This course will offer students with introductory orientation to contemporary numerical algorithms, scientific computing and different types of optimization models using real world data driven approach. Active learning will be used in which students will learn to solve computational problems and data visualization techniques. We will begin the course with the history and background of algorithmic approaches to evolutionary computation. Students will be oriented to a set of classical biological and life sciences algorithmic as they related to computational problem solving and analysis. Lectures and assessments will cover major topics and hands on data driven approaches in computational mathematics with a range of numerical algorithms to data modelling, bio-inspired algorithms and swarm intelligence.

Prerequisite: Completion of or concurrent enrollment in MATH 115.

CYBR 305 – Healthcare Informatics & Technology 3 credit hours

With a focus on networking, this course will examine the healthcare field and its integration with the electronic and digital realm. Topics like security protocols, patient privacy, and telemedicine will be studied and then applied to real-world technical scenarios through discussion and hands-on projects.

CYBR 306 – Introduction to Predictive Modeling 3 credit hours

Data Analytics uses real-time processing of sentiment, buzz, social networks, context and/or other data of interest to improve performance and impact. This course will expand on basic statistical and analytical tools for developing an understanding of advanced methods for data analysis and modeling to support decision making. Students learn how to develop, explore, model, and answer questions using analytical processes to examine datasets, including "big data". Predictive modeling is introduced to show how to use these concepts, and others, to support more informed decisions and to drive business strategy using current and rapidly changing technologies. The course covers the fundamentals of databases, data analysis, data visualization, inferential statistics, and reporting; all supporting predictive and prescriptive analytics. Two hours lecture, two hours lab per week. Prior completion of LOPER 4 - Mathematics, Statistics and Quantitative Reasoning course is highly recommended.

CYBR 325 – Database Systems 3 credit hours

This course covers the design and implementation of database management systems. Topics include data models (relational, document, key/value); query languages (relational algebra, SQL, stored procedures); storage management; implementation techniques of database management systems (index structures, concurrency control, recovery, and query processing); parallel architectures (multi-core, distributed); management of semi structured and complex data; NewSQL, noSQL systems, and other tools for large-scale data analysis.

Prerequisite: CYBR 101

CYBR 330 – Algorithms and Data Structures 3 credit hours

A comprehensive study of data structures and algorithms with programming applications. Topics include: a review of basic data structures (linked-lists, stacks, queues) and abstract data types, advanced data structures and their associated algorithms, heaps, priority queues, hash tables, trees, binary search trees, and graphs, advanced sorting and searching algorithms, divide and conquer algorithms, greedy algorithms, and dynamic programming. Problem analysis is emphasized. Computability, asymptotic notation and NP-completeness are introduced. An object-oriented programming language will be used.

Prerequisite: CYBR 180 and grade of C-minus or better in CYBR 150

Additional Course Fee Required

CYBR 335 – Fundamentals of Networking & Systems 3 credit hours

This course is the first technical networking & systems course. A layered approach is used with discussion centered around physical connectivity, switching, routing, protocol discovery and application layer. Technical network design is introduced with a focus on hands-on labs.

Prerequisite: CYBR 101 or passing score on the CompTIA A+ certification exam.

Additional Course Fee Required

CYBR 337 – Graph Theory 3 credit hours

Graph theory is an important foundational computer science course which will offer students with theoretical and modelling concepts related to graph theoretic concepts as they related to construction and analysis of big data. We will introduce classical problems in graph theory starting with Königsberg bridge problem, Erdos graph, Erdos-Rényi model and how they relate to practical problem solving using Erdos collaboration graph. Conceptual and modelling challenges in constructing and interpreting graphs will be discussed. Other concepts such as the Marriage Problem, the Assignment Problem, the Network Flow Problem, and the Traveling Salesman Problem will be discussed. Students in this course will be expected to develop understanding of the graph theoretic modeling and analysis and its application within the context of large-scale network-based simulations for exploring big data visualization, cybersecurity threats data, and spatial and temporal data analysis.

Prerequisite: CYBR 150 and CYBR 180.

CYBR 340 – Information Networking Preceptorial 3 credit hours

Students in this course study the design and operation of telecommunications and information networks actively deployed in the business enterprise. They also explore the duties and responsibilities of the network manager as they maintain the information and telecommunications networks.

Prerequisite: CYBR 335

CYBR 345 – Intricacies of Advanced Networks & Systems 3 credit hours

This second technical networking & systems course looks in-depth at routing and switching protocols. Students will utilize the hands-on lab environment to examine the routing and switching protocols as well as a variety of other topics like enterprise wireless, network monitoring and high availability. Students with a strong command of the concepts presented will be prepared to sit for specific industry certification exams. Two hours lecture, two hours lab per week.

Prerequisite: CYBR 335

Additional Course Fee Required

CYBR 348 – Systems Administration I 3 credit hours

This course provides a beginning overview for maintaining reliable systems in multi-user and device-diverse environments. This course focuses on managing infrastructure servers and their services; disaster recovery techniques; and the interaction between systems administration and the entire IT environment.

Prerequisite: CYBR 335

CYBR 381 – Systems Analysis and Design I 3 credit hours

Explore the systems life cycle. Learn tools and strategies for system and information analysis. Includes need identification, feasibility studies, requirements assessment, project management and group dynamics.

Prerequisite: CYBR 335

CYBR 399 – Independent Study in Cyber Systems 1-6 credit hours

This course provides the opportunity for students to conduct independent study on any cyber systems topic not covered by other regularly offered courses. The topic will be selected in consultation with and the study will be supervised by a cyber systems faculty member.

The project should be focused on an area of interest to the student. Upon completion of the project a formal presentation will be given by the student to all interested parties. A written contract specifying the topic and requirements must be submitted and approved by the department before registering for the course.

Department Consent Required

Total Credits Allowed: 6.00

Prerequisite: Junior or senior standing and permission of department chair

CYBR 400 – Exploring Computer Science Principles 3 credit hours

This course takes a broad approach to computer science, exploring the fundamentals of programming, data, and computer networks and systems. The course places an emphasis on creative and design thinking, which is central to computer innovation. This course is intended for students majoring in business and education, as well as any other student with an interest in computer science.

CYBR 404 – Systems and Software Engineering 3 credit hours

This course will include the fundamental principles of systems and software engineering. Software specification techniques: rigorous methods and formal methods. Software design: object-oriented design, function-oriented design, real-time systems design, user interface design. Programming techniques and tools. Software reuse and software metrics. Design patterns and component based software development. Computer-aided software engineering. Software validation and verification. The object oriented language Java will be used as the major programming language for this course.

Prerequisite: Junior or Senior standing

CYBR 405 – Interactive Web Application Development 3 credit hours

This course covers the wide range of state-of-the-art computer technologies for interactive web application development. Students will learn how to write both static web pages and dynamic web pages. This is a programming-intensive course.

Prerequisite: CYBR 101

CYBR 406 – Enterprise Application Development 3 credit hours

This course is designed to assist students in learning the skills necessary to design and build enterprise-level applications. Skills and knowledge gained in this course can be applied in the development of interactive web sites, electronic commerce systems, cloud-based applications and other service-based architectures. Security of internet based information systems will also be covered.

Prerequisite: CYBR 150

CYBR 408 – Principles of Programming Languages & Automata 3 credit hours

A study of the fundamental concepts of finite automata, computability, Turing machines, and grammars. This will then lead into programming language design concepts and semantics; examination of language features and major programming paradigms with a focus on functional programming; and design and implementation of language interpreters. Prerequisite: CYBR 301

CYBR 410 – Big Data Visualization 3 credit hours

This course provides an understanding of data analytics advanced techniques to extract knowledge about organizational activities from big data sources and to present their findings through writing and visualization. Managing, governing, extracting, merging, and preparing large data sets for analysis using real data are covered extensively. Prerequisite: CYBR 306

CYBR 412 – Fundamentals and Security of Mobile Networks 3 credit hours

This course is the first Mobile communication course. Topics covered include network architectures of different mobile technologies, radio communication, signaling protocols, mobile authentication, validation and key agreement.

Prerequisite: CYBR 158 and CYBR 335

CYBR 418 – E-Commerce Information Systems 3 credit hours

This course will present, develop, explore, and illustrate the nature and use of E-commerce Information System development methodologies in an inter-organizational setting, and discuss responsibilities at all life cycle stages. It is a comprehensive study of electronic commerce, with in-depth coverage of e-commerce technologies and e-commerce business models including business-to-consumer models, business-to-business models, consumer-to-consumer models, peer-to-peer models, and mobile commerce. It introduces global e-commerce, security and encryption issues, and ethical, social and political issues related to e-commerce. E-commerce interface designs for electronic storefronts, malls, catalogs, shopping carts, search engines, auctions, e-payment systems, e-learning, and e-government will be covered. Consumer interactions with payment processing mechanisms and relationships to information technology development and support will be studied.

Prerequisite: CYBR 101 or CYBR 102 or CYBR 103 or CYBR 302 or CYBR 434 and Sophomore standing or above

CYBR 421 – Business Process Redesign and ERP Systems 3 credit hours

This course provides an understanding of business processes and usage of various methods and computerized tools to redesign these processes. The redesigned processes will assist organizations in providing cost-effective quality products and services to consumers. Further, this course provides an overview of the Enterprise Resource Planning (ERP) Systems which are widely used by corporations for automation of their processes. Prerequisite: Junior standing

CYBR 422 – Computer Graphics 3 credit hours

Introduction to the techniques for generating lines, curves, surfaces, 2D and 3D graphics, modeling and rendering. Topics include display hardware, transformations, interactive technologies, geometric modeling, 2D and 3D display algorithms, graphics software system architecture, visible-surface algorithms, illumination and shading.

Prerequisite: CYBR 330

CYBR 425 – Applied Database Management Systems 3 credit hours

This is an interdisciplinary course designed for non-technical majors. This course is a comprehensive study of database concepts. The relational database along with proper database design will be emphasized. However, all types of databases will be studied. Additional concepts covered will be the normalization process and forms; structured query language (SQL); and various database management systems.

Prerequisite: CYBR 101

CYBR 430 – Defending & Protecting Cyber Systems 3 credit hours

This course will cover all the concepts necessary defense-in-depth of an enterprise network and system (blue team). A case study will be incorporated to achieve a strong understanding of the design, implementation and overall security of a large network. Hands-on labs will be conducted using a variety of networking and systems equipment. Students with a strong command of the concepts presented will be prepared to sit for specific industry certification exams. This course presents a comprehensive study of needs and characteristics of a global internetwork and the issues encountered on such a network. Topics studied will include security, servers, user identity, and wireless. Hands-on labs will be conducted using a variety of network equipment.

Prerequisite: CYBR 335

Additional Course Fee Required

CYBR 434 – Information Technology Teaching Methods 3 credit hours

This course will include information technology curriculum development and instruction, with a focus on applying programming concepts to K-12 education. Intended only for students in education fields.

Prerequisite: Junior or senior standing

CYBR 435 – Reverse Engineering: Thinking like an Adversary 3 credit hours

This course will cover all the concepts necessary to think like an adversary by breaking down malicious software using a reverse engineering approach. Different approaches and techniques will be used for comprehension and evaluation of sandboxing, obfuscation, with both static and dynamic analysis of software. In this manner, the students will learn how to better defend applications, systems and networks by comprehensively reverse engineering the offensive playbook.

Prerequisite: CYBR 335

Additional Course Fee Required

CYBR 440 – Systems Audit 3 credit hours

This course provides an understanding of many types of audit needs, such as organizational IT audits (management control over IT), technical IT audits (infrastructure, data centers, data communication), application IT audit (business, financial, operational), development/implementation IT audits (specification/requirements, design, development, and post development phases), and compliance IT audits involving national and international standards.

Prerequisite: Senior standing

CYBR 441 – Artificial Intelligence 3 credit hours

An in-depth study of intelligent agents, tree and search methods, constraint satisfaction problems, optimization problems, game-playing, logical analysis, and uncertainty modeling. Machine learning techniques are introduced. Applications to robotics, psychology, business intelligence and data mining are also discussed.

Prerequisite: CYBR 330

Additional Course Fee Required

CYBR 442 – Cryptography 3 credit hours

This course is an introduction to the fundamental theories and applications of cryptography techniques used in computer security and secure software development. Topics will include cyphers, cryptographic hashing, message integrity, authentication, key management, public-key infrastructure, encryption (secret-key and public-key), digital signatures, network security protocols, digital rights management, zero-knowledge protocols and quantum cryptography. The course is intended for advanced undergraduates with experience in theory of computation concepts, basic proof techniques, number theory and advanced programming.

Prerequisite: CYBR 330

CYBR 448 – System Administration II 3 credit hours

This course provides an advanced overview for maintaining reliable systems in multi-user and device-diverse environments. This course focuses on securing and hardening systems and servers; advanced authentication techniques; and advanced policy discussions on how to manage a complex systems environment.

Prerequisite: CYBR 348

CYBR 450 – Software Quality Assurance 3 credit hours

This course will provide students with the knowledge and skills to define and implement software quality management. We will explore ways to develop a quantifiably effective software quality management function and measure the success of quality assurance (QA) plans, teams and tools. The course will explore the latest industry standards, tools and approaches, and will explore the challenges of managing the QA function for modern software application environments.

Prerequisite: CYBR 381

CYBR 458 – Computer Security 3 credit hours

This course provides an overview of security issues associated with the development and deployment of information systems. Topics include authentication, encryption, firewalls, security standards and protocols, attack prevention, detection, and recovery.

Prerequisite: CYBR 101 or CYBR 102 or CYBR 103 or CYBR 235 or CYBR 448

CYBR 460 – Cloud Computing and Virtualization 3 credit hours

Examining the new world of virtualization, this technical essentials course looks at concepts such as cloud computing, virtualized hardware, networks, storage and data center concepts. Although the focus will be virtualization at the data center, these fundamentals are easily transferrable and highly needed in small to large enterprise. Topics such as hypervisors, software-defined networking and cloud architectures are discussed in-depth.

Prerequisite: CYBR 101

Additional Course Fee Required

CYBR 468 – Advanced Security: Playing Both Sides 3 credit hours

This course provides an introduction to advanced security topics associated with the development and deployment of information systems. Topics include WiFi and cellular networks, fuzzing, software vulnerabilities, and secure development practices.

Prerequisite: CYBR 435

CYBR 475 – Internship in Cyber Systems 1-6 credit hours

An internship is a professional or technical position in a professional environment that provides a student with sufficient practical work experience for a limited period of time, allows for career decision-making, and provides the employer valuable skills to accelerate business objectives. Internships are mutually beneficial for all involved. The student gains the opportunity to apply classroom learning to a workplace environment; the employer has the chance to work with students eager to learn and apply skills; and the university benefits from connections with business and industry, which provide potential for program development and enhancement. The learning experience is organized and supervised by the academic department, the CBT Career Center, and personnel of selected industries. All internships must be approved by the CBT Career Center and students must have a major or minor in the Cyber Systems department. The course will be evaluated on a credit/no credit basis.

Department Consent Required

Total Credits Allowed: 6.00

CYBR 478 – Cybersecurity for Managers & Leaders 3 credit hours

This course has been implemented for organizational leaders and managers, who are seeking knowledge that will help develop, or improve upon, a cybersecurity framework or program for their own organization (or future organization). Cybersecurity is an enterprise-level management challenge that has far-reaching impacts on all organizational levels. This course will cover cybersecurity frameworks and vocabulary to help build the cyber leadership and management skills needed to better prepare organizations for current and future cyber threats.

CYBR 479 – Cyber Risk and Threat Modeling 3 credit hours

This course covers the scientific concepts cyber risk and threat modeling. In contrast to popular cybersecurity management courses covering best practices, this course equips the students with the scientific mindset and tools needed to understand dynamic networks and security that exceeds the limitations of static networks. This course opens a window into the future of strategic cybersecurity.

Prerequisite: CYBR 478

CYBR 485 – Information Systems Strategy and Management 3 credit hours

To provide a set of practical and powerful tools to ensure the understanding of strategic, tactical, and operational responsibilities of the chief information officer (CIO). The strategic responsibilities include the strategic alignment among information technology and business functions of the organizations.

Prerequisite: Junior or Senior standing

CYBR 486 – Machine Learning 3 credit hours

This course provides an introduction to theoretical foundations, algorithms, and methodologies for machine learning, beginning with topics such as classification and linear regression and ending up with more recent topics such as boosting, support vector machines, hidden Markov models, and Bayesian networks. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is statistical inference as it provides the foundation for most of the methods covered. The course will end with a look at more advanced techniques, such as building ensembles, deep learning, and practical limitations of predictive models.

Prerequisite: CYBR 190 and CYBR 330

CYBR 490 – Information Networking Law and Public Policy 3 credit hours

This course provides a current and historical review of statutes, regulations, and municipal ordinances in telecommunications and information network security. Fundamental cybersecurity requirements are examined for several industry sectors. Topics also include network breach notification requirements, the NIST Risk Management Framework and NIST Cybersecurity Framework.

Prerequisite: Junior or Senior standing.

CYBR 491 – Analysis of Spatial and Temporal Data 3 credit hours

The course is conceptualized to introduce students to statistical analysis in temporal and spatial domain. This course will focus on applications of spatial, temporal, and spatio-temporal statistical methodology.

Emphasis will be on: (i) exploring and visualizing spatio-temporal data, (ii) specifying appropriate statistical models for natural processes in time and space, (iii) assessing and validating statistical models, and (iv) interpreting and communicating analyses of spatio-temporal data. The course will cover a mixture of mathematical properties of spatio-temporal models and implementation using R/Python.

Prerequisite: CYBR 486

CYBR 492 – Computational Natural Language Processing 3 credit hours

Natural Language Processing (NLP) is at the heart of many of today's most exciting technological achievements, including machine translation, automatic conversational assistants and Internet search. This course covers both fundamental and cutting-edge topics in NLP and provides students with hands-on experience in NLP applications in the form of programming assignments in Python, and a group project where students have the freedom to pick the programming tools of their choice. Students will develop an in-depth understanding of both the algorithms available for processing linguistic information and the underlying computational properties of natural languages. This course will introduce NLP methods and applications including probabilistic language models, machine translation, and parsing algorithms for syntax and the deeper meaning of text.

Prerequisite: CYBR 486

CYBR 493 – Social Dynamics of Cybercrime 3 credit hours

This course takes a multidisciplinary perspective for understanding how social dynamics of individuals, groups or organizations. We will introduce students with social dynamics modeling approaches drawn from social networks analysis combined with text mining or natural language processing to develop statistical model representative of cybercrime behavior. Using social networks, dynamic modeling of networks and organizational risk analyzer toolkit, this course will offer students a broader theoretical and methodological understanding of how these network-based modelling toolkits can be used for predicting cybercrime. We will first introduce a set of theories and methodological approaches drawn from social networks theories and analysis and use social networks modelling toolkit to demonstrate its usability in understanding and predicting cybercrime behavior. This course will conclude with connecting social dynamics and modelling approaches to understanding technology-driven crime and corporate challenges related to cyber threats, ransomware attacks and preventative measures for safeguarding corporate information.

CYBR 494 – Directed Research in Cyber Systems 1-6 credit hours

Independent original research in a Cyber Systems area, under the direction of a Cyber Systems faculty member. A written contract specifying the topic and requirements must be submitted and approved by the department before registering for the course. Upon completion of the project a formal presentation will be given by the student to all interested parties.

Department Consent Required

Total Credits Allowed: 6.00

Prerequisite: Junior or senior standing and permission of department

CYBR 495 – Cyber Systems Capstone 3 credit hours

This course provides experience and background that will prepare the student for an actual working environment. Reinforcement and validation of knowledge gained in previous course work, enhancement of communication skills, and learning to work with people will be emphasized. Primary tasks will include a team-based project using technologies appropriate to the student's program of study, the study of ethics for cyber systems professionals, and project design and development and project oversight using appropriate project management tools. This course also provides opportunity for writing in the cyber systems disciplines.

Prerequisite: CYBR 101 and Senior standing or permission of Department
Additional Course Fee Required

CYBR 498 – Special Topics in Cyber Systems 3 credit hours

Course is designed to enable students to become knowledgeable of recent trends and issues in cyber systems. The course format varies depending on subject matter, instructor and student needs.

Total Credits Allowed: 6.00

CYBR 499 – Special Problems 1-3 credit hours

Independent investigations of organizational problems. Topics to be investigated may be tailored to meet the needs of the student. The course is designed to integrate the knowledge acquired in other courses in the student's program of study and provides the opportunity for students to conduct independent study on any cyber systems topic not covered by other regularly offered courses. The study topic will be selected in consultation with the supervising cyber system's faculty member. A written contract specifying the topic and requirements must be submitted and approved by the department before registering for the course.

Department Consent Required

Total Credits Allowed: 6.00

Prerequisite: Junior or senior standing