Henry Edwin Sever Institute

With flexible schedules, including evening and weekend classes, professionals can keep their careers moving while developing the knowledge and credentials that will set them apart. Our graduate students strive to make a positive impact on the challenges we face in technology, security and information management. The curriculum and course work will enhance students' knowledge and expertise. They will understand the rapidly changing marketplace and be prepared to set the pace.

Degree Programs

- Master of Construction Management (http://bulletin.wustl.edu/prior/2018-19/grad/engineering/sever/construction-management)
- Master of Project Management (http://bulletin.wustl.edu/prior/2018-19/grad/engineering/sever/project-management)

Graduate Certificates

- Graduate Certificate in Construction Management (http://bulletin.wustl.edu/prior/2018-19/grad/engineering/sever/construction-management)
- Graduate Certificate in Cybersecurity Management (http://bulletin.wustl.edu/prior/2018-19/grad/engineering/sever/cyber-security-management)
- Graduate Certificate in Information Systems Management (http://bulletin.wustl.edu/prior/2018-19/grad/engineering/sever/information-systems-management)
- Graduate Certificate in Project Management (http://bulletin.wustl.edu/prior/2018-19/grad/engineering/sever/project-management)

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Courses

Courses include:

- T55 ETEM (p. 1): Engineering Management
- T60 GSever (p. 2): General Professional Education
- T64 CNST (p. 2): Construction Management
- T71 HlthCare (p. 4): Health Care Operations
- T81 INFO (p. 4): Information Management

Engineering Management


T55 ETEM 500 Independent Study
Credit variable, maximum 6 units.

T55 ETEM 502 Strategic Management of Technology
Analytical methods for strategic management are reviewed. Technology strategy is linked to the strategic plan for the organization, and methods to accomplish this linkage are developed. Factors that characterize and encourage innovation are discussed. A process for managing and integrating new technology into the strategic process is developed. Throughout the course, cases are used to analyze and demonstrate the several elements of strategic management of technology. Prerequisite: graduate standing; permission of instructor required, background or course work in presentation skills is recommended.
Credit 3 units.

T55 ETEM 504 Engineering Management
Discover the full picture of how business works within the organization. This course walks the student through the complete business cycle — the roles the various functions play in a business operation and the interactions between them. To bring these learnings to life, this course also uses management simulation games and classroom competitions. Includes strategy, product planning and management, sales and support, research and development, manufacturing and supply chain, as well as accounting and finance. Prerequisite: graduate standing.
Credit 3 units.

T55 ETEM 505 Decision-Making & Optimization
Expand your ability to analyze and optimize complex business situations by leveraging the key data. Decision-making in today's complex world requires advanced analytical methods and tools, including mathematical modeling and quantitative techniques. Powerful tools for forecasting, finance, operations, production and logistics. Emerging technologies such as the Industrial Internet of Things (I-IoT) and Block Chain are enabling a whole new set of possibilities! Prerequisite: graduate standing, statistics.
Credit 3 units.
T55 ETEM 506 Technology Strategy & Marketing
Learn the art and science of technology-rich strategy and marketing. Every business rises and falls on the value it brings to the customer and the value it simultaneously brings to the business itself. The engineer that understands and can communicate strategy and marketing is powerful! Business, technology and research budgets are allocated based on this value proposition, whether the commercialization or operationalization of the technology is one year out or 10 years out. Prerequisite: graduate standing. Credit 3 units.

T55 ETEM 510 Understanding Emerging & Disruptive Technologies
We live in an era of rapid technology innovation and disruption. Blockbuster was the darling of Wall Street in 2004 and filed for bankruptcy in 2010. Blockbuster CEO in 2008: “Neither Redbox nor Netflix are even on the radar screen in terms of competition.” Blockbuster is not alone in their blindness. Microsoft laughed off the first i-phone, and laughed off Google. IBM laughed off the first personal computer. These should be a horrible warning to all business leaders. Numerous technologies are threatening disruption today: block chain, Internet of Things (IoT), artificial intelligence, autonomous vehicles, unmanned aerial vehicles (UAVs), 3D Printing, 5G wireless networks, gene editing. Understanding what they are and how they might disrupt will make or break countless companies in the coming years. Prerequisite: graduate standing. Credit 3 units.

T55 ETEM 521 Human Performance in the Organization
Gain insights and practice in the art and science of leadership. This course addresses the leadership and management capabilities required to move into positions of greater responsibility, with a focus on technology-based organizations. Topics include leadership, goals, motivation and performance, management of change, conflict and effectiveness, organizational development and work design. Because when a leader gets better, everyone gets better. Credit 3 units.

T55 ETEM 523A Project Planning Methodologies
Build your expertise with today’s critical project management methodologies in our fast-paced world. Variations of waterfall are widely used in industry, but new uses of agile are being discovered every day, both inside and outside of software-based organizations. This course exposes the student to the fundamental and emerging techniques and tools to manage successful projects of various sizes and complexity - managing cost, schedule, quality, risk, solution and requirements - while adapting to today’s fast-paced and uncertain business environment. The primary focus of this course is on agile. Prerequisite: graduate standing. Credit 3 units.

T55 ETEM 534A Principles of Operations Management
Examination of quantitative and managerial approaches for the planning, scheduling and control of production and inventories in manufacturing companies. Review various models for demand forecasting, capacity planning, lot-sizing, scheduling, and shop-floor controls in various types of manufacturing environments. Analysis of techniques such as MRP II, JIT and Kanban in production scheduling and control.

T55 ETEM 535 Productivity & Quality Control
This course provides a comprehensive coverage of quality and productivity improvement concepts for operations management. Students face realities that confront managers involved with the concurrent optimization goals of customer satisfaction and profit improvement. Theoretical and business applications are presented to provide a sound understanding of the basic principles of quality and productivity management in both a manufacturing and services business environment. The student will study contemporary management principles such as: total quality planning using the Malcolm Baldrige assessment, product reliability concepts, statistical process control, outsourcing management, customer requirements evaluation, total cost of quality assessment, productivity performance measurement and control, and others. Credit 3 units.

T55 ETEM 537 Lean Manufacturing and Management
Lean principles and techniques will be explored and exercised to use as a competitive advantage for manufacturing and engineering-based companies. The driving force and economics of lean, supply chain management, value stream mapping, set-up reduction, Just-in-Time, managing variations, and cultural issues surrounding lean implementation are examined. Credit 3 units.

General Professional Education
Visit online course listings to view semester offerings for T60 GSever (https://courses.wustl.edu/CourseInfo.aspx?sch=T&dept=T60).

T60 GSever 502 Financial Principles of the Company
Demystify the fiscal management practices and financial statements of the company. There is a story behind every set of financial data. This course examines the underpinnings of financial accounting and management, including financial reporting processes and uses of accounting data, links between accounting information and management planning, decisions and controls. The course is divided into three phases: (1) introducing financial concepts and principles, (2) performing and evaluating financial analysis, and (3) utilizing case studies to develop a business correction plan for an ailing organization. Prerequisite: graduate standing. Credit 3 units.

Construction Management
Visit online course listings to view semester offerings for T64 CNST (https://courses.wustl.edu/CourseInfo.aspx?sch=T&dept=T64).

T64 CNST 523A Construction Cost Estimating
Construction cost estimating explores the application of cost estimating principles and estimating within a project management framework in conjunction with scope definition, quality control, planning and scheduling, risk management and loss prevention techniques, local conditions, information and
communication, and working relations with stakeholders. Using a single building project, the course introduces the application of basic quantity surveying and estimating principles using a methodical approach with suggested check lists and techniques for arriving at a reliable cost estimate including direct, indirect, and contingency costs and profits. Student's estimating efforts culminate with a competitive bid day scenario. Prerequisites: T64-573 or permission of instructor. Credit 3 units.

**T64 CNST 550A Special Topics: Sustainable Construction**
The course will focus on global, national and regional sustainability issues; history of the movement; ethical issues; ecological design; legal/risk/challenges; costs of green building; national and international green building rating systems; current and potential future trends and successful practices of sustainable planning, design and construction. Also covered is how LEED Accredited Professionals manage the building certification process and documentation required for successful LEED certification. At the end of this course, students should be prepared to take the USGBC LEED Green Associate (GA) Exam Structure and have a working knowledge of the requirements for USGBC LEED v4 Specialty Exams. Additional self-study will be required after the course to fully prepare for any exam. Prerequisites: graduate standing, and CNST 573 or permission of instructor. Credit 1.5 units.

**T64 CNST 550B Special Topics in Construction Management**
This course focuses on the foundational issues of securing new business while ensuring project and company profitability. Topics include creating and implementing marketing and business development strategies; customer relations management; developing competitive strategies for delivering professional construction services; bidding strategies; developing public relations strategies; managerial leadership: strategic planning. Prerequisites: CNST 573 or permission of instructor. In preparation for this course, some study materials will be provided to enrolled students approximately two weeks prior to the first meeting. Section 01: This course is being taught on two consecutive weekends. Credit 1.5 units.

**T64 CNST 550C Special Topics in Construction Management**
Fundamentals of the safety management process and the use of safety programs to include hazard recognition, field safety meetings/management, OSHA documentation requirements, coordination of contractor and subcontractor relationship. Prerequisites: graduate standing, and CNST 573 or permission of instructor. Credit 1.5 units.

**T64 CNST 550D Special Topic: Heavy Civil Construction Management**
This course provides a broad perspective of the means, methods and procedures associated with managing civil engineering and heavy construction projects. Topics include strategic bidding and estimating, heavy equipment, marine construction heavy civil operations and bridge building. Integration of scheduling, estimating, and construction contracts with a project-based approach. (Three half-day Saturday site visits are required.) Prerequisites: graduate standing, and CNST 573 or permission of instructor. Credit 3 units.

**T64 CNST 572 Legal Aspects of Construction**
A survey of the legal problems of the construction manager, including but not limited to, liability in the areas of contracts, agency, torts, insurance, bad judgment and oversight. Prerequisite: graduate standing. Credit 3 units.

**T64 CNST 573 Fundamentals in Construction Management**
In this course, students will be exposed to the overall construction process from initial concept through startup of the completed facility. The focus is to provide familiarization of the construction and contracting process and potential involvements by construction managers in the planning, design, construction and post-construction phases. Additional topics are introduced to provide a foundation which will prepare students for future construction management course work. Case studies and industry examples are used throughout the course to authenticate the lectures and assignments. Prerequisite: graduate standing. Credit 3 units.

**T64 CNST 574C Construction Project Planning and Scheduling**
Project planning and scheduling process utilizing current techniques including critical path analysis for effective and logical scheduling of construction projects. Identification of project activities and their relationships; schedule development, analysis and updating; relationship of project costs and resources to the schedule; legal implications; effective communication of schedule information; development of procedures to monitor actual field progress; computer application in project scheduling. Prerequisites: T64-573 or permission of instructor. Credit 3 units.

**T64 CNST 579 Advanced Construction Management**
A comprehensive study of the operations encountered in the management of a construction firm. Topics include: estimating, scheduling, forms of contracts, risk analysis and management, extra work orders, claims and disputes, construction safety, and contract close-out. Prerequisites: T64-573, T64-574, T64-523A, and permission of program director. Credit 3 units.

**T64 CNST 580B Digital Construction Technology**
This course focuses on BIM's philosophy of integration between designers, construction professionals and owners, in order to overcome both technological and implementation changes using Virtual Design and Construction (VDC) and Integrated Project Delivery (IPD). VDC is a methodology that relies on a multidisciplinary collaboration of the digital simulation of design & construction. IPD, on the other hand, integrates people, systems, business structures and practices into a process to optimize efficiency and productivity. In this course, students will learn about BIM's application by exploring 3D, 4D aspects of BIM including geometry, spatial relationships, quantity take off, estimation and scheduling. Along with that, students also will learn about Virtual Design and Construction (VDC) and Integrated Project Delivery (IPD) systems that are integral components of successful BIM projects. Credit 3 units.
T64 CNST 581A MCM - MArch Capstone Project Phase 1
This capstone course allows MCM/MArch joint degree program students to apply constructability principles to their MArch degree project (A46 ARCH 616) and successfully demonstrate how they have applied those principles. Constructability principles include: analysis of the construction methods and procedures, project cost, time, value, quality and safety. Phase 1 is to be taken simultaneously with A46 ARCH 616 Degree Project. Phase 1 students will develop a constructability review, analysis and plan for their individual project. Prerequisites: admission to MCM/MArch joint program, CNST 573, 523A, 574C.
Credit 1 unit.

T64 CNST 581B MCM - MArch Capstone Project Phase 2
This capstone course allows MCM/MArch joint degree program students to apply constructability principles to their MArch degree project (A46 ARCH 616) and successfully demonstrate how they have applied those principles. Constructability principles include: analysis of the construction methods and procedures, project cost, time, value, quality and safety. Phase 2 is to be taken after completing A46 ARCH 616 Degree Project. Phase 2 students will execute the constructability plan developed in Phase 1 and prepare and present the deliverables. Prerequisite: CNST 581A.
Credit 2 units.

Health Care Operations
Visit online course listings to view semester offerings for T71 HlthCare.

T71 HlthCare 501 Introductory Overview of Operational Excellence in Health Care
This introductory course is designed to prepare students for the Master's of Healthcare Operational Excellence program. Students will learn the fundamentals of operational excellence principles and how the organizational complexities, regulatory and economic framework, and nuances of healthcare impact the ability to apply them. Students will research and explore both healthcare and non-healthcare examples of performance improvement and operational excellence efforts within different organizations and from different stakeholder perspectives. Throughout the course, students will gain an understanding of how the various methods, both social and technical, can play an integral role in achieving operational excellence, and how to identify and mitigate challenges and barriers. Specific methods will include facilitating teams, change management, lean, six sigma, project management and the importance of principle-based deployments rooted in changing behaviors and transforming culture. By completing this introductory overview course, students will understand the level of personal transformation in mindset and skills that will be necessary in order to successfully impact the changes needed for health care operational excellence.
Credit 3 units.

T71 HlthCare 503 Lean Healthcare Concepts, Tools and Lean Management Systems
Students will learn and apply core Lean tools including Value Stream Mapping, 5S, Visual Management, Standard Work, JIT, Push/Pull, Error Proofing, and Daily Management. Critical to applying Lean effectively, participants will also learn how to plan and lead Rapid Improvement Events and other group activities and tactics. This program has been adopted by BJC executive leadership and is identified as a core competency for transformational efforts. Students will also learn the essential elements of a Lean Management System and how to accomplish sustainable results and the development of a continuous improvement culture.
Credit 3 units.

Information Management
Visit online course listings to view semester offerings for T81 INFO.

T81 INFO 500 Independent Study
Prerequisite: departmental approval.
Credit 3 units.

T81 INFO 503D Applying Innovations within Organizations
This course focuses on how innovations, such as new technologies, find their way into organizations through managerial approaches. Topics will include assimilation and diffusion of technology, effects of technology on organizations and organizations on technology, and how organizations may be analyzed to assess the role of innovations. Emphasis will be placed on how to understand the organization's social system and what can be done to prepare it for an innovation. Disruptive technologies, organizational culture, and how organizations change will also be covered. Prerequisite: appropriate background.
Credit 3 units.

T81 INFO 507D Information Management and Enterprise Transformation
The modern enterprise relies heavily on information management. As enterprises transform to keep pace with business realities such as globalization, mergers/acquisitions, and proliferation of new business models, management needs to reconsider technology infrastructures, social infrastructures, re-engineering business processes, outsourcing, and measuring/ managing technology knowledge. The roles of CIOs and IT professionals, power teams, and leadership issues concerning change will be covered.
Credit 3 units.

T81 INFO 509B Leading Teams and Projects
Establishing a personal leadership style, assessing people, and recognizing/establishing authority on a project will be covered. Handling project meetings and dealing with key stakeholder communication will be given emphasis. Teamwork will be highlighted through discussion of various kinds of teams, team structure and team formation. The virtual team style will also be reviewed.
Credit 3 units.
T81 INFO 516B Principles and Practice of Information-Systems Engineering Analysis
This course describes the corporate IS requirements assessment and planning process. It covers the development of an information architecture and a technology architecture. An enterprise model is discussed from the aspects of subject areas, entities and processes. Details concerning data analysis are covered and include data entities, entity attributes, entity relationships, and macro/micro data modeling. Diagramming tools for data modeling will be used. Details of process analysis are covered, and tools will be used for hierarchical decomposition, data flows and action diagrams.
Credit 3 units.

T81 INFO 517 Service Management
This course focuses on the IT service life cycle and its value to the business. This in-depth study of service strategy, service design, service transition, and service operations will provide the student with an understanding of the 26 IT Infrastructure Library (ITIL) processes. Through the application of continuous service improvement, students will understand the IT service life cycle and will also be able to assess the effectiveness of processes and services. This course includes case studies, lectures and group activities to enhance the textbook material.
Credit 3 units.

T81 INFO 527 Introduction to Big Data, Business Process Modeling and Data Management
This course is designed to introduce basic concepts of “Big Data” and the impact these technologies have on society and the enterprise. The course will describe various types of “Big Data” implementations, but will focus on the business value that such technologies may allow the enterprise, as well as the risks that can arise from managing the large volume of data that new technology allows. The course will cover a broad spectrum of data fundamental terms, definitions, historical perspectives, and current trends with a focus on big data as a business consideration in an ever-changing world of technological advances and business needs. The course will introduce key big data concepts and terminology that will allow both the business leader and the technical engineer the ability to converse in terms relevant to both disciplines. This course is expected to raise the general awareness of business and technical professionals about the threats, risks and control needs in the cyber-evolving world around them and provide a road map for big data implementations and projects in small and large enterprises.
Credit 3 units.

T81 INFO 535A Economics of Technology
This course is designed to familiarize the student with microeconomic principles and managerial economics. Where possible, the course utilizes examples from technology environments and information systems. The focus is on incentives and decision-making by individuals and firms and the aggregation of these decision-making agents into industries and markets. Business decision-making in the face of changing technology will be emphasized. The principles presented will be relevant both for managing a business as well as evaluating sound public policy.
Credit 3 units.

T81 INFO 5502 The Art and Science of Risk Management
This course focuses on why many project managers miss requirements for schedule, budget or even both. The course concentrates on key risk management techniques practiced by leading project and program managers and taught through fact-filled lecture, case work and project execution as applied to information systems, engineering, financial, product/process and design projects/programs in today’s fast-moving environment. Students will take away key value propositions including risk identification, risk quantification, risk monitoring, risk control and risk mitigation. This course will enable the student to address common scope, schedule, quality and cost risk events that occur on complex projects. Project risk management examines the types of risk, with a focus on understanding the process of risk identification, assessment, prevention, mitigation and recovery; governance, auditing, and control of the confidentiality; integrity; and availability of data. Using common operational, strategic, tactical, and technological scenarios, the course work provides a comprehensive approach to the challenges faced by managers where global data is readily available, risk is pervasive, regulations are ever-increasing, and the threat of disruption from potential crises is real.
Credit 3 units.

T81 INFO 5503 Developing Leadership for Professionals
Provides knowledge about a variety of leadership approaches and how they may be effective in technological situations. The course concentrates on developing skills to actually lead in various situations. These include decision-making, problem solving, coaching, evaluating performance, selling ideas, and gaining commitment. Combines classroom, actual experiences, and reality-based feedback to hone skills resulting in a higher ability to lead.
Credit 3 units.

T81 INFO 5504 Foundations in Project Management
A practical orientation for using what is known about organizations and how to apply this knowledge to managing projects. Review of the project management paradigm, the basic ingredients of a project, critical stakeholders and roles, and the normal project life cycle will be provided. An introduction to the project management maturity model is covered along with explanations for ways to integrate current and future knowledge into the model. How project approaches should differ by how to segment the problem space — monolithic, incremental or evolutionary.
Credit 3 units.

T81 INFO 5506 Group Dynamics in Project Team Performance
This course examines how teams actually work, looking at group behavior in social situations and how various leaders perform in these social situations. Group motivations of teams are also examined in light of the local situation and/or a large enterprise. Identifying the enabling conditions for team formation and the importance of context to team performance. The idea of a standard normal person and how it relates to team behavior. Subject areas covered include: groupthink and the impact on projects; social facilitation with key stakeholders; project uncertainty and the dynamics of contribution; project and organizational climate. Prerequisite: T81-509B.
Credit 3 units.
T81 INFO 5507 Strategies of Projects, Programs and Portfolios
This course addresses the strategic alignment and prioritization of multiple and complex projects with an organization's business objectives and directions. Major areas covered include: stakeholder value, return on investment, balancing the trade-off between project priorities and operational imperative business benefit; establish and implement program governance of multiple projects to ensure consistent alignment with organizational strategy; balancing and coordination of project resources across multiple projects; coordination of schedules among multiple projects using traditional and advanced methods; current trends and practices in program and project portfolio management. Prerequisite: T81-5504. Credit 3 units.

T81 INFO 5508 Advances in Project Management
This course examines various aspects of organizations and project performance from actual cases. Aspects include the project decision making environment, the enterprise culture, leadership attributes, changes due to project creativity, success of reasoning within a project and how projects are actually learning environments. Credit 3 units.

T81 INFO 556 Advanced Risk Analysis and Response Planning
This course develops mastery-level skills to allow the risk practitioner to focus on meeting threat and opportunity uncertainty challenges in rapidly changing project and business environments and on developing competencies needed for the future project and portfolio success. Advanced application of quantitative risk analysis, dual contingency analysis, advanced decision analysis, risk valuation, and risk data accuracy/precision are covered. Advanced contingency planning with predictive analytics will be included. Key business environments that would leverage these competencies include information technology, cybersecurity, engineering, manufacturing, procurement and financial services. Focus areas of discussion include: 1. Expose risk practitioners to advanced risk response planning for threat avoidance, mitigation and transferring risk to appropriate stakeholders. Advanced response planning for exploiting, enhancing and sharing opportunities will be addressed. 2. Critical decision analysis incorporating risk will be covered. Key risk management capabilities and trends that affect organizations in the 21st century — cybersecurity, financial uncertainty, global management, entrepreneurship, employee competency risk, team-based management and managing risk threats and opportunities in a competitive and ethical manner — will be examined. 3. Develop competency at predicting the likelihood (probability) and consequence (impact) associated with risk events. This includes determining how project outcome can be affected by known and unknown risks. Prioritization and valuation of multiple risks; determining project risk scores to aid in portfolio analysis, strategic capital allocation and maximizing alignment to business strategies. 4. Expanded quantitative analysis including asymmetrical, symmetrical and uniform probabilistic distribution scenarios. This will include expanded Monte Carlo simulations to predict risk probability of project completing according to baseline schedule, cost, and likelihood of risk occurrence. Expanded decision tree analysis, annotations and calculations will be mastered. 5. Learn how to develop detailed and proactive risk triggers indicative of pending risk event occurrence. Development of secondary risk, contingency plans and fallback plans will also be included. 6. Practical methodology of decision analysis and alternative evaluations of multiple options to select course of action with most probable success and crisis avoidance. Use of Monte Carlo analysis and decision tree analysis will be covered to address risky decisions facing key leaders. Innovation-based risk analysis will be discussed for leading edge technology, cyber and software applications. 7. Current risk certification requirements, corporate application and value proposition for CISSP®, PMI-RMP®, etc., will be examined. Basic necessities related to corporate procurement applications will be presented for application in outsourcing, contracts, joint ventures/acquisition activities, etc. Credit 3 units.

T81 INFO 557 Privacy in the Digital Age
The reduction of the cost of storing and manipulating information has led organizations to capture increasing amounts of information about individual behavior. New trade-offs have emerged for parties involved with privacy-enhancing or intrusive technologies: individuals want to avoid the misuse of the information they pass along to others, but they also want to share enough information to achieve satisfactory interactions; organizations want to know more about the parties with which they interact, but they do not want to alienate them with policies deemed as intrusive. Is there a "sweet" spot that satisfies the interests of all parties? Is there a combination of technological solutions, economic incentives, and legal safeguards that is acceptable for the individual and beneficial to society? Privacy is a complex and multifaceted concept. This course combines technical, economic, legal, and policy perspectives to present a holistic view of its role and value in the digital age. It begins by comparing early definitions of privacy to the current information-focused debate. It then focuses on: technological aspects of privacy (privacy concerns raised by new IT such as the internet, wireless communications and computer matching; tracking techniques and data mining; privacy enhancing technologies and anonymous protocols); economic aspects (economic models of the market for privacy; financial risks caused by privacy violations; the value of customer information); legal aspects (laissez-faire versus regulated approaches; US versus EU legal safeguards); managerial implications (the emerging role of chief privacy officers; compulsory directives and self-regulative efforts); policy aspects (trade-offs between individual privacy rights and societal needs). The course will consist of a combination of readings, assignments and class discussions. Assignments will include essays and technical projects. Credit 3 units.

T81 INFO 558 Applications of Deep Neural Networks
Deep learning is a group of exciting new technologies for neural networks. Through a combination of advanced training techniques and neural network architectural components, it is now possible to create neural networks of much greater complexity. Deep learning allows a neural network to learn hierarchies of information in a way that is like the function of the human brain. This course will introduce the student to computer vision with Convolution Neural Networks (CNN), time series analysis with Long Short-Term Memory (LSTM), classic neural network structures and application to computer security. High Performance Computing (HPC) aspects will demonstrate how deep learning can be leveraged both on graphical processing units (GPUs), as well as grids. Focus is primarily upon the application of deep learning to problems, with some introduction mathematical foundations. Students will use the Python programming language to implement deep
learning using Google TensorFlow and Keras. It is not necessary to know Python prior to this course; however, familiarity of at least one programming language is assumed. This course will be delivered in a hybrid format that includes both classroom and online instruction.
Credit 3 units.

**T81 INFO 560 Systematic View of Cybersecurity & Information Assurance**
Information security is paramount to the health of a successful enterprise. Learn what it takes to manage and operate an information security program in an enterprise. The focus is on areas such as risk assessment, risk management, incident handling and business continuity planning. Learn the vocabulary, vernacular and terminology used in the information security space. Learn what keeps chief security officers, their teams and the business clients they serve "awake at night," and what you can do, as an information security professional to protect your clients.
Credit 3 units.

**T81 INFO 561 A View from the Bridge: Being at the Forefront of Enterprise Information Security**
This class discusses the "How-To's" in developing, organizing, staffing and leading an information security organization from inception through maturity. How it is supported by the CSIS Top 20 Critical Controls will also be a focal point of the course. We will discuss how to manage the harmony between regulatory standards, information security best practices, and organizational practices and procedures in establishing and leading an effective cybersecurity organization. Because organizations and their information systems constantly change, the activities within the security management process must be revised continuously, in order to stay up-to-date and effective. Security management is a continuous process, and it can be compared to W. Edwards Deming's Quality Circle (Plan, Do, Check, Act); Control Case International 2012). Students will study initial security policies that stipulate requirements about ethics, confidentiality and integrity. Techniques for implementing and technical controls for enforcing these policies are investigated, including access control mechanisms, user authentication, configuration and vulnerability management techniques, and networking tools such as firewalls and intrusion detection systems. This course explores, more deeply, the principles of information technology governance, focusing on IT control objectives (COBIT) and related internal controls. Course work provides a deeper understanding of best practices for managing cybersecurity processes and meeting multiple needs of enterprise management by balancing the void between business risks, technical issues, control needs and reporting metrics.
Credit 3 units.

**T81 INFO 562 Threat Intelligence & Intrusion Incident Management**
This course focuses on gaining the knowledge and insight to defend an enterprise from cyber threats. Using the cyber kill chain process as the organizing construct for the class, students will learn how CISOs defend a company's internal and external environment by protecting, detecting and responding to cyber threats. Students will learn to define critical security teams and controls, effectively organize an incident response team, use cyber threat intelligence, understand network security tools, participate in red and blue team exercises, deploy enterprise digital computer forensics, and conduct targeted cyber threat hunting. Using recent examples of cyber breaches and incidents, students explore how CISOs react and respond to cyber breaches and incidents and learn best practices in doing so. Learning what it takes to build an enterprise-wide cybersecurity awareness program and analysis of cybersecurity vendor resources will also be covered.
Credit 3 units.

**T81 INFO 567 Enterprise Network Security**
Some of today's most damaging attacks on computer systems involve the exploitation of network infrastructure, either as the target of attack or as a vehicle to advance attacks on end systems. This course provides an in-depth study of the ITIL methodology in securing the network against various attack techniques. It will explore ITIL methods to defend against them. Topics include firewalls and virtual private networks; network intrusion detection; denial-of-service (DoS) and distributed denial-of-service (DDoS) attacks; DoS and DDoS detection and reaction; worm and virus propagation; tracing the source of attacks; traffic analysis; techniques for hiding the source or destination of network traffic; secure routing protocols; protocol scrubbing; and advanced techniques for reacting to network attacks.
Credit 3 units.

**T81 INFO 575 Data Warehousing**
This course will introduce students to the major activities involved in data warehousing and its application to a business. The class will concentrate on topics such as: requirements gathering for data warehousing, business constraints, data warehouse technologies and architectures, dimensional model design, entity relationship model design, physical database design for data warehousing, extracting, transforming, and loading strategies, introduction to business intelligence and reporting, expansion and support of a data warehouse. Once the basic principles have been established, the remainder of the class will be built around a group data warehouse project. The project will begin with student groups gathering requirements and developing a data warehouse design. Once the design is complete, students will build a prototype data warehouse containing the necessary structures within their database and populating them with source data. This will require students to develop the table definitions, extract/transform/load (ETL) logic, and example report definitions. We intend this class to be a hands-on example of a simple data warehouse implementation. Focus areas and skills obtained after completion of the course: gather requirements for data warehousing, explain data warehouse technologies and architecture, understand the advantages and disadvantages of both dimensional and ER modeling for data warehousing, identify data sources, design a physical model for data warehousing, comprehend extract, transform and load strategies, design and develop business reports and business considerations for expanding and supporting a data warehouse.
Credit 3 units.

**T81 INFO 576 Predictive Modeling for Large Scale Data Analytics**
This course in predictive modeling provides a foundation for large-scale data analytics by teaching statistical analysis and data capture methods for general purpose use across a corporation. Focus areas include large-scale data validation and
analysis for competitive business intelligence and security (i.e., cyber intelligence).
Credit 3 units.

T81 INFO 578 Security Auditing
This course provides information technology (IT) professionals an understanding of how security auditing can be successfully integrated as an important component in an effective organizational cybersecurity program. The course provides students practical information to successfully prepare for an internal or external IT audit, use security auditing to reduce risk, and enhance the overall cyber defense environment within their organization. The course provides an overview of the most prevalent types of IT audits affecting organizations, presents a structured methodology for conducting internal audits or preparing for an external audit, and examines challenges and future trends to security auditing brought about by cloud computing, regulatory trends, and other factors. Through the course material, discussions and case studies, students will acquire practical security auditing concepts and principles that can be applied within their organizations to enhance cybersecurity.
Credit 3 units.

T81 INFO 581B Perspectives on Technology and Innovation
Understanding the role that new technologies can play in achieving the strategic vision and thus shareholder value of the firm will be the focus of this course. This includes reviewing appropriate ways of judging a technology and whether a repositioned technology can drive business value. Students will participate in a process of discovery and judgment rationalization that will lead to understanding how to bring together the technical and commercial worlds in a profitable way. A discussion of the key concepts that would take to distinguish between activities and outcomes. Technological innovations (outcomes) are normally the result of product, process, market development and administrative capabilities. Students will discuss strategy, visioning, formulation and execution. How does innovation and growth enter into it? Innovation and growth innovation in design; interaction with customers; in business processes; in management thinking? How you build an innovation strategy will be the capstone of the course.
Credit 3 units.

T81 INFO 584 Communication Excellence for Influential Leadership
Exceptional communicators become extraordinary leaders. This course will guide students to learn to exceptionally communicate their message by applying refined nuances that inspire and transform those with whom they converse. Through a proven communicative process, students will acquire skills necessary to differentiate them as leaders. Students will learn how to communicate across a variety of settings using strategies that result in clear, vivid, and engaging exchanges. Students will practice: storytelling; creating and using clear visuals; engaging listeners; demonstrating passion when speaking; responding to questions with clarity and brevity, and, using their distinctive voice as a leadership asset. Each student will learn how to assess his or her own communication capabilities, adjust to different listeners, and how to evaluate speaker effectiveness and provide valuable feedback to others. Video recordings will be used to demonstrate incremental communicative changes throughout the course, and to show how these strategies bring about outstanding leadership.
Credit 3 units.

T81 INFO 585 Cybersecurity Capstone
The capstone project is a culmination of a student's prior course work and is taken toward the end of their program. It gives the student the opportunity to utilize the hard-earned knowledge and skills they have developed as an MCSM student in a real-world setting. The project gives them a chance to apply business judgment and cybersecurity models to current and emerging opportunities as they confront, create and present a comprehensive cybersecurity plan to a panel of cybersecurity industry experts. MCSM students can choose to apply their efforts for their capstone experience to the strategic benefit of their current companies, while others may desire to display more of a holistic focus to the capstone, taking advantage of the project to understand different industry issues.
Credit 3 units.

T81 INFO 587 Mobile Security and BYOD
The proportion of mobile devices providing open platform functionality is expected to continue to increase in the future. The openness of these platforms offers significant opportunities to all parts of the mobile ecosystem by delivering the ability for flexible program and service delivery options that may be installed, removed or refreshed multiple times in line with the user's needs and requirements. However, with openness comes responsibility, and unrestricted access to mobile resources and APIs by applications of unknown or untrusted origin could result in damage to the user, the device, the network or all of these. This course will explore how to build and manage suitable security architectures and network precautions.
Credit 3 units.

T81 INFO 588 Cryptography
As the world becomes increasingly dependent on digital communications, computing and information, the need for robust cybersecurity becomes ever more paramount. Within this context, cryptography becomes an indispensable component of any cybersecurity system. The purpose of this course is to equip cybersecurity professionals with a firm understanding of cryptographic principles and applications and how cryptography can be used to secure, protect and safeguard the organization's communications and information. Students will survey the history of cryptography, the evolution of cryptographic algorithms including important symmetric and asymmetric approaches, hashing, authentication and digital signatures, mutual trust, public key infrastructure, key management, user authentication, and cryptographic attacks. Particular focus will be placed on the integration of cryptography within the organization's IT infrastructure to include IPSec; email, wireless, and data encryption and how to analyze, support and present the business case for cryptography in the IT enterprise. Note: Although cryptography is a mathematically intense discipline, the course will be taught from a managerial perspective. As such, the course is self-contained mathematically, and students are not required to have an extensive math background, although some college-based course work is recommended.
Credit 3 units.

T81 INFO 589 Business Continuity and Disaster Recovery
This comprehensive course provides up-to-date assessments and understanding on issues that will affect you and your company. Issues such as earthquakes, hurricanes, acts of terrorism, communication, cybersecurity and news media events
will be discussed by an expert who has led disaster recovery efforts through most of these events. Students will have the opportunity to interact with experts in these areas and gain practical knowledge about how to respond and deal with large-scale events affecting the enterprise. By the end of this course, the student will have a thorough comprehension of the tools, knowledge and understanding necessary to assess, benchmark and develop a wide-ranging disaster recovery and business continuity program. Credit 3 units.

T81 INFO 612 Taking Down the Cyber Criminal – Post Breach

Students will study the management and the communication of information that could be presented in court or could be used to facilitate other information that would be presented in court. The course will review the federal and certain state laws pertaining to the collection of evidence and evidence-related material and the successful submission of evidence to a court. In addition, strategies will be discussed as related to discovery of evidence and evidence-related material and the use of attorney-client privilege and work product to protect the client's interests with respect to such material. The students will also examine when reports should be drafted and examine the proper drafting and use of such reports as a submission to legal counsel, the court or to business. Further, the students will study effective testimony in a court of law that would include oral testimony and use of demonstrative evidence and material. Credit 3 units.