

Master of Science in Information Technology

Information Technology (IT) is pervasive today and is at the core of almost any organization- for-profit, non-profit, or governmental. The Master of Science in Information Technology program (MS-IT) is designed to provide students with a solid and forward-thinking technical foundation used to effectively plan, design, implement and manage IT solutions and systems. It prepares students to be strong technical leaders, ready to lead IT-enabled organizational change.

If you want to expand and deepen your technical skills, add to your business knowledge and prepare for systems analysis, cybersecurity and project management, this degree is for you. As an MS-IT graduate, you will be prepared for a number of positions in the IT field including senior systems analyst, applications development manager, data center manager, cybersecurity analyst, technical services director, software engineer, database administrator, database engineer, and computer scientist. Other management-oriented roles include project manager, program manager, information security manager, and line management roles in technical organizations.

Goals of the Program

MS-IT students will learn and build on the shared knowledge characteristic of all elements of technology leadership including the following:

1. **FUNDAMENTALS:** Graduates of the School of Management are equipped with knowledge of the essential concepts and tools in their professional field, as well as the ability to relate and apply theoretical concepts into practical situations both within their discipline and across disciplines.
2. **PLANNING AND ORGANIZATION:** Graduates of the School of Management have the ability to plan, organize, direct and control effectively in contemporary organizations.
3. **INDIVIDUAL COMPETENCIES:** Graduates of the School of Management have individual competencies related to critical and creative thinking, integrity and ethical judgment, and the ability to function in a complex and demanding professional environment.
4. **INTERPERSONAL COMPETENCIES:** Graduates of the School of Management have interpersonal competencies related to effective and appropriate communication and collaboration that support and enhance their individual and organizational effectiveness.
5. **GLOBAL ENVIRONMENT:** Graduates of the School of Management have a sound understanding of the global environment and its importance to organizational effectiveness, as well as the ability to successfully operate in an international context.
6. **LEADERSHIP AND CHANGE:** Graduates of the School of Management are able to demonstrate strong technical leadership in their field including how to manage and influence IT-enabled organizational change in complex and dynamic environments.
7. **TECHNOLOGY and INNOVATION:** Graduates of the Masters of Science in Information Technology program are able to effectively design, manage and utilize technology to enhance enterprise operations and business processes, as well as drive organizational innovation by creating new IT-enabled business opportunities.
8. **DATA AND ANALYTICS:** Graduates of the Masters of Science in Information Technology program are able to assess organizational data and information requirements, build and implement data models as well as use basic and advanced analytics tools to derive meaning from the data.
9. **CYBERSECURITY STRATEGY AND DEFENSE:** Graduates of the Masters of Science in Information Technology program are able to assess information security risks and develop and implement solutions to protect organizational systems from cyber threats through offensive and defensive planning and incident response.

Academic Calendar

Master of Science in Information Technology courses are offered year round in four 11-week terms: Fall, Winter, Spring and Summer. Classes are scheduled in the evening once a week to accommodate adult learners who are employed full time and pursuing course work on a part-time basis. Occasionally, a class will be offered in a compressed weekend format or as an International travel course. Based on admission requirements, time to complete the program can take between one and seven years. Students must complete the program within seven years after their first registration.

Admission Requirements

International applicants are subject to separate admission procedures. For current admission procedures, international applicants should consult the following: www.callutheran.edu/management (<http://www.callutheran.edu/management/>).

Candidates for admission to the MS-IT program should submit a complete application portfolio at least 45 days prior to the start of the term. Admission decisions for regular graduate standing are based on a review of the following materials in the candidate's file:

1. A completed application form and non-refundable application fee;
2. Evidence of an interview with an admission counselor;

3. Official transcripts showing a bachelor's degree from a regionally accredited U.S. institution. Normally, a grade point average of 3.0 or higher in upper division undergraduate work is expected;
4. Two letters of recommendation;
5. A personal statement;
6. Test scores. Applicants who undergraduate records do not satisfy the criteria set forth in one of the paragraphs 1-4 below must include Graduate Management Admission Test (GMAT) or Graduate Record Examination (GRE) scores in their admission portfolio. The GMAT may be waived for candidates who present an official transcript of previous college work from a regionally accredited college or university reflecting any one of the following criteria:
 - a. An undergraduate, upper division grade point average of 3.0 or higher on a 4.0 scale; or
 - b. A combined grade point average of 3.0 or higher for the most recent 60 credits of study consisting of any of the following: graduate course work, upper division postbaccalaureate course work (exclusive of extension or continuing education work), and upper division undergraduate course work; or
 - c. A minimum of nine credits of graduate course work completed and a 3.50 grade point average; or
 - d. A previously earned master's degree.

Admission to the MS-IT program requires at least one year of work experience and one of the following:

- A prior technical bachelor's degree and one year of hands-on programming coursework or work experience; OR
- A prior non-technical bachelor's degree and three years of technical work experience, including one year of hands-on programming coursework or experience.

Note: All applicants who have completed their undergraduate work at other than a regionally accredited U.S. institution must submit GMAT scores.

Admission Counseling

Prior to enrollment in graduate classes, the applicant must make an appointment for an advisement interview with an admission counselor. This exploratory interview will clarify individual program requirements and provide the opportunity to answer students' questions. Counselors are available by appointment.

Provisional Admission

Under some conditions, after meeting with an admission counselor and with the approval of the Program Director, a student may register for classes before completing the entire admission process. However, the Application for Admission, the \$50 application fee, and a copy of a transcript showing a bachelor's degree with an acceptable GPA and/or acceptable standardized test score must be on file in the Graduate and Adult Programs Office before the class registration can be accepted. Students are expected to complete all admission requirements in the first term of their program or they will not be permitted to enroll in subsequent terms. Provisionally admitted students are not eligible for financial aid.

Master of Science in Information Technology

The curriculum includes a total of 12 graduate courses (36 credits) total. Students will take eight core courses and four elective courses in their specialized track.

Students can obtain a general MS-IT degree by selecting elective courses across tracks. Students with backgrounds that are not in Information Technology (IT) or business may need foundation courses which do not count towards the 36 credits required for the degree.

Students who wish to apply an elective course to a specialization track that is not explicitly listed under the Course List for that track will need to submit a Graduate Substitution Form. Substitutions must be discussed and approved by the program director prior to the start of the term in which you will be taking the substituted course.

Required of all Students

IT 508	Information Technology Management	3
IT 509	Data Management	3
IT 510	Software Planning and Development	3
IT 511	Data Communications and Networking	3
IT 512	Project Management	3
IT 513	Information Security	3
IT 514	Distributed Systems	3
IT 516	Data Structures and Algorithms	3

Information Technology Management Track

Take 4 courses (12 credits) from the following:

IT 520	IT Strategy and Business Value	3
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IT 521	Healthcare Information Technologies	3
IT 522	Enterprise Systems	3
IT 523	IT Architecture and Infrastructure	3
IT 524	Emergent Technologies and Issues	3
IT 582	Special Topic (Track Related)	3
IT 590	Internship (Track Related)	1-3
IT 599	IT Project (Track Related)	3

Data Analytics Track

Take 4 courses (12 credits) from the following:

IT 530	Principles of Data Analytics	3
IT 531	Data Mining	3
IT 532	Data Warehouse/Bus Intelligence	3
IT 533	Big Data Technologies	3
ITM 534	Social Media Analytics	3
IT 582	Special Topic (Track Related)	3
IT 590	Internship (Track Related)	1-3
IT 599	IT Project (Track Related)	3

Cybersecurity Track

Take 4 courses (12 credits) from the following:

IT 540	Digital Forensics	3
IT 542	Ethical Hacking	3
IT 544	Cloud Security	3
IT 546	Cybersecurity Risk Management	3
IT 582	Special Topic (Track Related)	3
IT 590	Internship (Track Related)	1-3
IT 599	IT Project (Track Related)	3

Note: IT 531 or IT 533 may be applied to the cybersecurity track in place of one elective requirement. The remaining 9 credits must be cybersecurity electives.

Courses

IT 500. Foundations Adv & Prof Practices. (3).

This course provides the student with knowledge, skills and abilities to academic and professional practices that are needed in order to succeed in the CLU School of Management's graduate programs. The course focuses on the development of written and oral communication skills, computer skills, and creative and critical thinking. Students will learn how to plan, research, organize, prepare and professionally present major academic reports using current presentation technologies for team projects and individual assignments.

IT 501. Fundamentals of Java Programming. (3).

Java is one of the most popular programming languages used by software developers today. This course introduces students to the fundamental programming concepts and techniques in object-oriented programming. This course has both theoretical and practical components. It provides students with a solid foundation needed to understand how computer programs work. Students will also learn how to write, execute and debug various Java programs. This is a foundation course for all students interested in a career in the Information Technology field whether they manage the technology or actively develop it. [Note: this is a prerequisite course for any student without technical background.].

IT 502. Foundation of Business Statistics. (3).

This course is designed to help the entering graduate students to acquire a good intuitive grasp of statistics - what is is, how and when to apply statistical techniques to managerial situations, and how to interpret results. Various statistical and mathematical techniques will be presented to assist in solving problems encountered by corporate managers. Students need to demonstrate knowledge of the course concepts by knowing which decisions, comparisons, and inferences to make in the presence of uncertainty.

IT 508. Information Technology Management. (3).

In today's dynamic and competitive economy, the ability of an organization to effectively leverage their existing and emerging information technologies is a critical success factor in gaining and sustaining a strategic advantage. This course introduces students to important concepts and techniques needed to understand and leverage information technology within an organizational context. Students will learn the fundamentals of design and implementation of information systems in the modern organization, business process improvement through the use of information technology, project management concepts, data governance mechanisms, and technology-enabled change management among others.

IT 509. Data Management. (3).

Data is a valuable organizational resource. As organizations collect more and more data, it becomes increasingly important to understand basic principles of how to store and manipulate organizational data in order to successfully run business operations. This course provides students with an introduction to the fundamental concepts, techniques and tools used in design, development and application of relational database technology in organizations. Topics include data modeling based on organizational requirements and data manipulation via structured query language tools.

IT 510. Software Planning and Development. (3).

This course uses structured software development methodologies to develop an understanding of the overall process of developing an information system starting with planning, analysis, design and implementation of the system. It focuses on the core set of skills that all analysts must possess, from gathering requirements and modeling business needs, to creating blueprints for how the system should be built and assessing usability of the system. The course also exposes students to various graphic modeling processes such as data flow diagrams used in business process reengineering, design of user interfaces and system behaviors.

IT 511. Data Communications and Networking. (3).

This course introduces the elements and architecture of computer and data communication networks, demonstrates the fundamental principles of computer networking, and provides experience in the practical use of current networking technology. Topics in this course include: network standards, protocols (TCP/IP), network architectures, network routing and switching, local area networks, wide area networks, knowledgeable decisions pertaining to strategies and architectures for the deployment of telecommunication technologies in organizations.

IT 512. Project Management. (3).

This course is an introduction to the basic fundamentals of project management based on the Project Management Institute (PMI) body of knowledge. All phases of the project management cycle are covered including project initiating, planning, executing, monitoring and controlling project status and post project lessons learned analysis. In addition, the course introduces the 10 project management knowledge areas as defined by PMI namely, project integration, scope, time, cost, quality, human resources, communications, stakeholder, risk, and procurement management. Project management best practices, tools and techniques along with constraints and trade-offs in managing projects are discussed. The course has a practical component with students executing projects as part of teams.

IT 513. Information Security. (3).

Security of informational assets has become a keenly debated issue for organizations. Effective information security management demands a clear understanding of technical as well as socio-organizational aspects. The purpose of this course is to prepare students to recognize the threats and vulnerabilities present in current information systems and how to plan for such risks. The course covers a broad range of topics including data classification, cryptography, network and application security, risk management, threat and vulnerability analysis, computer forensics, and policies and architecture designs. Students will have the opportunity to try real security and attack tools to understand how they work and how they might be used and counteracted.

IT 514. Distributed Systems. (3).

From mobile phones to the Internet, our lives depend increasingly on distributed systems linking computers and other devices together in a seamless and transparent way. This course provides students an understanding of the principles on which the Internet and other distributed systems are based, their architecture, algorithms and design and how they meet the demands of contemporary distributed applications through topics such as client/server software and N-tier architectures, middleware, Internet technologies, application development, system management, mobile and ubiquitous computing and distributed multimedia systems. Students will also learn the distributed systems infrastructure that supports Google both in terms of core search functionality and the increasing range of additional services offered by Google.

IT 515. Organizational Behavior. (3).

Investigation and consideration of individual and group behavior within an organizational context is explored. Focus is on the understanding and application of knowledge issues including motivation, group process, leadership, communication, performance enhancement, power and influence, creativity, conflict management, change, diversity and global issues. Integration of theory and practice from a managerial perspective are considered.

IT 516. Data Structures and Algorithms. (3).

Data structures are ways to organize, store and retrieve data while algorithms are strategies for processing the data to solve computational problems. Efficient computer applications require good use of data structures and algorithms. This course introduces students to analysis and design of fundamental data structures and algorithms that are the basis of modern applications today. Students will learn to write algorithms, evaluate tradeoffs between different algorithms and assess the efficiency of the best possible algorithm for solving complex computational problems. Pre-requisites: IT-508 and IT-501.

IT 520. IT Strategy and Business Value. (3).

This course explores strategic information technology management issues associated with doing business in digital times. It provides a framework to understand how information technology strategy aligns with business strategy and focuses on developing an understanding of the key information requirements for developing information technology strategy and systems architecture. Students are encouraged to think and behave strategically with respect to exploiting leading-edge technologies, and deliver the right business value with information technology. The course will focus on digital technology trends transforming how business is done, information management and architecture, e-business models and strategies, mobile commerce, social networking, engagement and social metrics and business process innovation.

IT 521. Healthcare Information Technologies. (3).

The current trend towards computerizing the healthcare industry through interoperable electronic health records (EHR) is creating very exciting opportunities for IT and business professionals in a diverse range of organizations including hospitals, IT firms (EHR vendors), government departments and health funds. This course is designed to introduce students to the various aspects of information management in healthcare organizations. Students will also gain a solid understanding of the healthcare field and how advanced information technologies can be used to reduce costs and improve the healthcare system overall. At the same time, the course focuses on unintended consequences resulting from deployment of advanced technologies in the healthcare field including user responses and usability considerations. Privacy and security laws in HIPAA will also be discussed.

IT 522. Enterprise Systems. (3).

Integration of information and processes is one of the biggest challenges faced by organizations today. Enterprise systems attempt to integrate all departments and functions across an organization onto a single computer system that can serve every department's particular needs for up-to-date and accurate data. These systems dictate a standard data format across the entire organization, they are modular and multifunctional. This course examines various types of enterprise systems such as enterprise resource planning (ERP) systems, supply chain management systems (SCM), customer relationship management systems (CRM) and knowledge management systems (KM) that support and enhance business activities. It provides an overview of the managerial and technical issues in selection and implementation of enterprise systems and technologies.

IT 523. IT Architecture and Infrastructure. (3).

Organizations entrust a large portion of their budget to people who lead and manage IT infrastructure and operations. The ability to respond dynamically to changing business requirements is paramount for IT infrastructure and operations (I&O) organizations. Virtualization, IT modernization, and real-time infrastructure architecture are increasingly essential to this agility. This class will balance hands on interaction with infrastructure technologies and equipment as well as applications of technologies and services. Other topics include enterprise architecture and governance, cloud computing, enterprise-wide efficiency, and green computing.

IT 524. Emergent Technologies and Issues. (3).

Organizations must structure themselves to deal with emerging technologies and making the right decisions, at the right time, can be critical to determining whether the organization succeeds or fails. This course provides students with a basic understanding of emerging technologies as they relate to innovation and information systems in organizations, and the management strategies required to understand, leverage, and benefit from these technologies. Students will identify current, real technologies that are emerging or about to emerge into the mainstream, investigate those technologies, and ones from recent history, from a number of perspectives, to look at the impact of technologies on systems, business operations, and corporate and technology strategy. They will study the impact, benefits and downsides of standards as they related to information technology and delve into how those standards, and other factors, might affect the timing for implementation of emerging technologies in organizations.

IT 530. Principles of Data Analytics. (3).

This course provides an introduction to the field of business analytics, which is defined as the extensive use of data, statistical and quantitative analysis, exploratory and predictive models, and fact-based management to drive decisions and actions. Topics include implementation of successful analytics platforms, big and little data, predictive analytics, social media analytics, mobile analytics and data visualization. Students use industry standard tools in practical projects.

IT 531. Data Mining. (3).

Data mining is the process of discovering patterns and associations in large data sets. It supports decision making by detecting patterns, devising rules, identifying new decision alternatives and making predictions. This course provides an overview of leading data mining methods and their applications to real-world problems. It is designed to provide students with the skills to conduct data mining and statistical analysis for dealing with analytical tasks such as prediction, classification, decision trees and clustering. Students will use available software to conduct various data mining analyses and understand the application of a wide range of modern techniques to specific managerial and analytical situations, and on model interpretation.

IT 532. Data Warehouse/Bus Intelligence. (3).

This course introduces the principles and procedures related to the design and management of data warehouse (DW) and business intelligence (BI) systems. The DW is the central data repository that is used for decision-support. BI refers to the analytical applications that users can interact with in making sense of the data. The course focuses on the data warehousing process including requirement collection, data warehouse architectures, dimensional modeling, extracting, transforming, and loading strategies, and creation of data marts. The course also uses data warehousing as a platform for BI applications, such as reporting, dashboards and online analytical processing (OLAP). By completing this course, students should understand the technologies used for decision-support and possess valuable analytical skills.

IT 533. Big Data Technologies. (3).

More and more organizations are collecting large amounts of data, much of it unstructured. Big data technologies can be used to store, process and analyze large amounts of data using a distributed environment. This course introduces students to the world of big data and associated technologies. The focus of the course is Apache Hadoop, which is an open source software project that enables, distributed processing of large data sets across clusters of commodity servers. The objective of this course is to provide students a foundation for understanding big data technologies and Hadoop in particular. Topics include Hadoop system architecture, Hadoop Distributed File System (HDFS), MapReduce programming model and design patterns and technologies surrounding Hadoop ecosystem such as Pig, Hive and Oozie. The course will also introduce big data science concepts and NoSQL database technologies.

IT 540. Digital Forensics. (3).

Modern technologies have created a myriad of ways that data can be stored and communicated - and hidden. Digital forensics is the science of finding those data after the fact. This course presents an overview of the principles and practices of digital investigation and prepares students to conduct a cyber forensics investigation in an organized and systematic way. The course allows students to develop skills in collecting, seizing and analyzing suspect devices, creating forensics images, recovering deleted data from various file systems and damaged media, applying digital forensics techniques to e-mail and other electronic communications and describing incident and intrusion response approaches, among other topics. PREREQUISITES: IT508 and IT513.

IT 542. Ethical Hacking. (3).

Ethical hacking or penetration testing is the act of breaking into a system with the permission and legal consent of the organization or individual who owns and operates the system, with the purpose of identifying vulnerabilities to strengthening the organization's security. This course introduces students to the principles and techniques of the cybersecurity practice known as penetration testing and covers various tools and methods commonly used to compromise and control access to information systems. As part of this course, students will conduct hands-on penetration tests in a controlled lab environment, discover how system vulnerabilities can be exploited and learn how to avoid such problems in order to better secure organizational data and systems. Prerequisites: IT 508 and IT 513.

IT 544. Cloud Security. (3).

Cloud computing services (whereby distributed resources are rented, rather than owned) are being adopted across a variety of organizations yet many security challenges exist. This course introduces students to various cloud computing architectures and delivery models followed by a review of the security and privacy issues related to various types of cloud computing environments. The course covers aspects related to cloud security design, implementation, architecture, operations, controls, and compliance with regulatory frameworks for both cloud platforms & infrastructure security and cloud application security. Prerequisites: IT 508 and IT 513.

IT 546. Cybersecurity Risk Management. (3).

Protecting organizational assets against increased numbers of cybersecurity threats is of critical importance in all modern organizations. Having a cybersecurity plan and a governance structure in place for dealing with cybersecurity risks is a more successful strategy than recovering organizational systems after a cyberattack has occurred. This course introduces students to risk management approaches for identifying, analyzing and responding to cybersecurity risks, governance mechanisms, human resource security and business continuity. This course provides students with necessary skills required to formulate and implement a cybersecurity plan. Prerequisites: IT 508 and IT 513.

IT 582. Special Topic. (3).

This course is designed and taught by a rotating cohort of instructors and is dedicated to special topics in information technology not covered by the current curriculum. Special topics courses vary and are used to introduce students to new topics in the Information Technology field.

IT 590. Internship. (1-3).

Internships are a valuable experiential learning tool where students engage in work with an organization on an approved topic. Students will write a comprehensive report based on their learning experience along with weekly logs and managerial evaluation. The report will be evaluated and graded by the instructor.

IT 599. IT Project. (3).

Students will work on proposing, developing and implementing a comprehensive project on concepts learned during their program. A project is a form of research aimed at creating or contributing new knowledge in a discipline or, an applied study that combines a specific topic with actual problems or issues within a setting.