

Information Technology

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Degree Offered: B.S. in Information Technology

Information Technology (IT) is an evolving interdisciplinary subject that has been driven and shaped by the rapid development of computing, communication, and Internet-related technologies and their tremendous impact on our daily lives. In contrast to the more traditional Information Systems discipline, Information Technology deals with the development, utilization, interrelation, and confluence of computers, networking, telecommunication, business, and technology management in the context of the global Internet. As we progress through the Information Age of the 21st century and see society increasingly dependent on Information Technology, we conclude that the demand for IT professionals will remain high throughout the decades to come.

The *Bachelor of Science in Information Technology* program at New Mexico Tech is administered jointly by the *Computer Science & Engineering* and *Management* departments. The curriculum includes relevant computer science, management, and engineering courses and emphasizes secure information systems and information assurance that are among the areas of research at Tech's Institute for Complex Additive Systems Analysis (ICASA) where IT students may find employment or internship opportunities. Students must also take a sequence of 12 hours of technical electives to broaden or deepen their knowledge in an IT area of their interest. Graduates of the IT program will be well prepared for immediate industry employment or graduate study in an IT-related discipline.

Undergraduate Program

Bachelor of Science in Information Technology

Minimum credit hours required—130

In addition to the General Education Core Curriculum (page 89), the following courses are required:

- CSE 222 (3), 241 (3)
- IT 101 (2), IT 113 (4), 122 (3), 213 (3), 221 (3), 263 (3), 311 (3), 321 (3), 326 (3), 351 (3), 373 (3), 382 (3), 481 (3), 482 (3)
- MATH 283 (3)
- PSY 121 (3) (can be applied as a social science course in the general education core curriculum)
- Technical Electives: a sequence of 12 hours of computer science, information technology, or management courses numbered 300 or higher must be *pre-approved* by the student's advisor and an IT Program Coordinator. Students are encouraged to select a coherent set of courses as technical electives that will prepare them for a specific focus in their career.
- Each of the above courses must be completed with a grade of C or better.
- Electives to complete 130 credit hours.

Sample Curriculum for the *Bachelor of Science in Information Technology* degree

Semester 1

- 4 MATH 131 (calculus)
- 2 IT 101 (introduction to comp sci & information tech)
- 4 IT 113 (introduction to programming)
- 3 ENGL 111 (college English)
- 13 Total credit hours

Semester 2

- 4 MATH 132 (calculus)
- 3 IT 122 (algorithms and data structures)
- 4 CHEM 121 & 121L (general)
- 3 ENGL 112 (college English)
- 14 Total credit hours

Semester 2.5 (Summer)

- 4 CHEM 122 & 122L (general chemistry II)
- 4 Total credit hours

Semester 3

- 3 IT 221 (computer and network organization)
- 3 IT 263 (information protection and security)
- 3 CSE 241 (foundations of computer science)
- 5 PHYS 121 & 121L (general)
- 3 PSY 121 (general psychology)
- 17 Total credit hours

Semester 4

- 3 CSE 222 (systems programming)
- 3 IT 351 (complex system modeling and simulation)
- 3 IT 213 (intro to object oriented programming)
- 3 MATH 283 (introduction to applied statistics)
- 5 PHYS 122 & 122L (general)
- 17 Total credit hours

Semester 5

- 3 IT 321 (internet and web programming)
- 3 IT 311 (human info processing and decision making)
- 3 IT 373 (intro to database design and management)
- 3 ENGL 341 (technical writing)
- 3 Social Science
- 1 Elective
- 16 Total credit hours

Semester 6

- 3 IT 326 (software engineering)
- 3 IT 382 (legal and ethical info technology issues)
- 4 Biology/Earth Science/Engineering with lab
- 6 Electives
- 16 Total credit hours

Semester 7

6	Technical Electives
3	IT 481 (senior secure system design project)
3	Social Science
3	Humanities
3	Electives
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18	Total credit hours

Semester 8

6	Technical Electives
3	IT 482 (senior secure system design project)
3	Humanities/Social Science
3	Electives
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15	Total credit hours

Information Technology Courses:

IT 101, Introduction to Computer Science & Information Technology, 2 cr, 2 cl hrs

Brief overview of the discipline of computer science and information technology topics including computer architecture, operating systems and networks, automata and models of computation, programming languages and compilers, data structures, algorithms, databases, security and information assurance, artificial intelligence, graphics, and social/ethical issues of computing. (Same as CSE 101)

IT 107, Introduction to Computer Programming using Python, 4 cr, 3 cl hrs, 2 lab hrs

Co-requisite: Math 103

The course is designed to introduce programming and its applications to scientists and engineers. The first part of the class focuses on problem solving, algorithm development, top-down design, modular programming, debugging, testing, data types, flow-control, looping, iteration and recursion, fundamental data structures, and an introduction to object oriented programming. The second part of the class explores data analysis with Python.

IT 113, Introduction to Programming, 4 cr, 3 cl hrs, 3 lab hrs

Prerequisite: MATH 103 or equivalent

The course is designed to introduce problem solving and programming in C to Computer Science and Information Technology majors. Topics include algorithm development; top-down design; modular programming; debugging; testing; control structures including selection, iteration and recursion; data types including arrays, strings, pointers, and dynamic structures involving memory management. Concepts implemented through extensive programming using good programming style. (Same as CSE 113)

IT 122, Algorithms and Data Structures, 3 cr, 3 cl hrs

Prerequisite: IT 113

Corequisite: MATH 132

Fundamental data structures including linked lists, trees, hash tables, and graphs. Algorithms for sorting, searching, and other fundamental operations. Introduction to mathematical foundations for analysis of iterative and recursive algorithms and for basic correctness proofs. Analysis of algorithms. Implementation of selected algorithms using sound programming methodologies.. (Same as CSE 122).

IT 213, Introduction to Object Oriented Programming, 3 cr, 3 cl hrs

Prerequisite: IT 113, 122

Introduction to programming in an object oriented language (e.g., Java): review of problem solving, algorithm development, top-down design, modular programming, debugging, testing, control structures including selection, iteration and recursion, data types including arrays, strings, pointers, and dynamic structures. Object oriented concepts will include: objects, classes, inheritance, instances, methods, interfaces, packages, encapsulation, and polymorphism. Concepts implemented through extensive programming using good programming style. (Same as CSE 213)

IT 221, Computer and Network Organization, 3 cr, 3 cl hrs

Prerequisite: IT 122

The hardware/software interface. Basic organization of computers, operating systems, and computer networks. Memories, buses, interrupts, input and output, and instruction set architecture. Programming in assembly language. (Same as CSE 221)

IT 263, Information Protection and Security, 3 cr, 3 cl hrs

Prerequisite: IT 113;

Corequisite: IT 221

Concepts of information, message and data. Storage and transmission, retrieval and communications. Authorized users and penetrators. Threats to information confidentiality, integrity, availability, and accountability. Attacks. Degrees of security and costs. Protection mechanisms and security precautions. Authentication and authorization. Encryption. Secure operating systems, communications and networks. Defenses against viruses, worms, and hostile code.

IT 311, Human Information Processing and Decision Making, 3 cr, 3 cl

Prerequisite: PSY 121 and upper division standing in the IT program

Recent advances in knowledge about how people process and act upon information are presented. Models of human decision making are analyzed in the context of secure information systems and used to assess ways to best manage the people and technology associated with secure information systems.

IT 321, Internet and Web Programming, 3 cr, 3 cl hrs

Prerequisite: IT 213, 221

This course has a practical emphasis on the design and techniques for developing internet-based applications, mainly focusing on web programming. Topics include HTML, client-side scripting language (JavaScript), server-side programming (Servlets, JSP, and J2EE), and XML/web services (Java and .NET). This course will also cover some important topics needed for internet-based application developments, such as Internet architectures, basic object-oriented programming (OOP) concepts, and web security. Course work includes substantial programming homework and team-based projects. (Same as CSE 321)

IT 326, Software Engineering, 3 cr, 3 cl hrs

Prerequisites: IT 122, 213

This course provides the introductory overview of software engineering, concentrating on large-scale software system design and implementation. Topics include software life cycle, UML-based design language, design tools and techniques, design documentation, software testing, and software project management. Course work includes a team-based project. (Same as CSE 326)

IT 328, Secure Software Construction, 3 cr, 2 cl hrs, 1 lab hr

Prerequisite: CSE 222, IT 213

Formal methods and practical techniques for the specification, design, implementation, and validation of computer software. Current software engineering and management practices, with emphasis on ensuring software reliability, safety, and security. Course work includes a team project to develop a sizeable, real-world application software. (Same as CSE 328)

IT 351, Modeling and Simulation Technologies for Information Systems, 3 cr, 3cl hrs

Prerequisites: IT 122; CSE 241

Fundamentals and techniques for designing and using simulation, modeling, and optimization algorithms with applications in system performance modeling, business infrastructure modeling, and distributed and parallel computing. An introduction to advanced complex systems models. (Same as CSE 351)

IT 353, Data & Computer Communications, 3 cr, 3 cl hrs

Prerequisites: CSE 222

Basic concepts of data communication. Transmission media (wireline and wireless) characteristics and utilization. Digital and analog data signaling, modulation, and coding. Signal and channel analysis. Concepts from information theory. Data channel multiplexing and subnet switching. Fiber optics networking technology-- design and deployment, all-optical-fiber-networks, Synchronous and asynchronous carriers (DS, SONET/SDH). MAC protocols for channel access and allocation. Data link control, design issues, link management, error and flow control. Wireless technology and protocols standards-- IEEE 802.11 Terra b/s physical layer & 802.11 MAC sublayer protocols. Overview of the OSI vs. TCP/IP protocol stacks. The Internet protocol structure- "subnet" and interfaces. Examples of LAN, MAN, and WAN. Principles of internetworking: relays and protocols (bridges/routers/gateways) and , Introduction to Internet Security and protocols-- IPsec; VPN. (Same as IT 353)

IT 373, Introduction to Database Systems, 3 cr, 3 cl hrs

Prerequisite: IT 122; CSE 241

Conceptual modeling and database design using the entity-relationship model. The relational model; relational algebra and relational query languages; design theory for relational databases. Database integrity. Physical data organization. Introduction to problems of concurrency control, recovery, security, and distributed databases. Course work includes a project using SQL and the Oracle Database Management System. (Same as CSE 373)

IT 382, Legal, Ethical,& Social Issues of IT, 3 cr, 3 cl hrs

Prerequisite: IT 326

A survey of current legal IT (and general business and management) issues is presented in this course. Also, social and ethical issues associated with IT and management of secure information systems are surveyed and discussed.

IT 441, Cryptography and Applications, 3 cr, 3 cl hrs

Prerequisites: IT 122; CSE 241

This course provides an introductory overview of modern cryptographic theory and techniques, mainly focusing on their application into real systems. Topics include number theory, probability and information theory, computational complexity, symmetric and asymmetric cryptosystems, one-way functions, block and stream ciphers, Kerberos authentication systems, public key infrastructure (PKI), secure socket layer/transport layer security (SSL/TLS), and cryptographic protocols/applications in many real systems. (Same as

IT 441)

IT 451, Introduction to Parallel Processing, 3 cr, 3 cl hrs

Prerequisites: CSE 122 or IT 122

Introduction to supercomputers and massively-parallel machine architecture, models of parallel computation, parallel algorithms, synchronization, parallel languages, data and functional parallelism, parallel performance analysis, popular interfaces, and parallel debugging. Students will gain experience in parallelization of sequential algorithms and implementation of parallel algorithms. (Same as CSE 451)

IT 453, Computer Networks & the Internet, 3 cr, 3 cl hrs

Prerequisite: IT 353

Layering of protocols (ISO, ITU and TCP/IP stacks) and network architectures. Fiber optics technology and high speed networks. Internetworking: global addresses/names and translation, virtual networks and tunnels, routing, subnetting, IPv6, multicasting. Mobile IP. End-to-end protocols, TCP and UDP. Congestion control and resource allocation. Socket interfacing, client-server and API. The QoS mechanism integrated/differentiated, ATM QoS. Network security: information and link security, encryption, internetworking security, IPsec, firewalls, VPN, wireless security. (Same as CSE 453)

IT 462, Systems, Risk and Decision Analysis, 3 cr, 3 cl 3 hrs

Prerequisites: MATH 283 or 382; upper division standing

Analysis of systems and managerial decisions under conditions of risk or uncertainty. Optimal project evaluations and ranking of alternatives using expected value and expected utility criteria. Topics include risk sharing, Bayesian revision of probabilities, value of information, and preference assessment procedures. (Same as MGT 462)

IT 463, Information Assurance, 3 cr, 3 cl hrs

Prerequisite: Senior standing

Defense and offensive information warfare. Information system security. Computer break-ins, hacking, and other attack methods. Vulnerability and risk analysis. Theory and applications of cryptography. Intrusion detection and incident response. Security planning and management. (Same as CSE 463)

IT 476, Visualization, 3 cr, 3 cl hrs

Prerequisite: CSE 222 or consent of instructor

This course presents application of graphical visualization to current problems, with a focus on extracting and representing information in multidimensional data sets using 2D and 3D graphics. Topics include visualization tools and techniques, human vision and perception, color mapping, sound, data representation for insight extraction, time visualization, visual analytics, volume rendering, surface extraction and rendering. Students will develop visualizations of real world problems. (Same as CSE 476)

IT 481 / IT 482, Senior Secure System Design Project, 3 cr, 3 lab hrs ea

Prerequisite: must have completed all junior-level IT courses

A substantial system and security-related project taken over 2 regular semesters, under the supervision of a faculty member.