



# MASTER OF SCIENCE

# INFORMATION TECHNOLOGY

For more information contact:

Rochester Institute of Technology  
Department of Information Sciences & Technologies  
102 Lomb Memorial Drive  
70-2100  
Rochester, NY 14623-5603  
(585) 475-6179 or (585) 475-2700  
(585) 475-2181 (fax) or (585) 475-6584

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## Master of Science in Information Technology

Department of Information Sciences & Technologies

### Introduction

A quick glance at the headlines of any major newspaper or magazine gives a thumbnail summary of the evolving nature and the degree of interest in the contemporary world of information technology. *Time* magazine featured a cover story on the "Information Highway" early in the history of the internet; now it is a fundamental component of our culture. *Business Week* has reported that the promised productivity improvements due to information technology are finally beginning to occur. Communication companies promote connectivity with television ads demonstrating their flexibility for global communication networks.

In today's world computing technology is a mixture of computers and other multi-purpose devices, information media, and communication technologies. To be successfully deployed and utilized, these technologies must be filtered through an understanding of how humans need to use these evolving systems. As the name connotes, the academic discipline of information technology (IT) is an multifaceted study of computer hardware and software technologies, creative mediating tools, data repository strategies, communication technologies, and human performance theory and practices. This interdisciplinary mix is the foundation of the Master of Science in Information Technology degree at RIT.

Many industries now attest to the need for a different type of computing professional. In an interview early in the evolution of the IT discipline, the Director of the Technology Services Group at the Center for Professional Education, a corporate training organization, stated that corporations are looking for graduates with knowledge and abilities in information technology beyond the computing theory provided by older computing disciplines. Corporations are aware of the cost savings and performance improvements that are likely to arise when information technology is applied in a systematic manner to improve organizational information flow, employee learning, and business performance.<sup>1</sup>

Process re-engineering has become a buzzword in the business community, referring to the overall organizational changes that must occur if businesses are to take full competitive advantage of new information technologies.<sup>2</sup> For decades, businesses have used computers and other advanced technologies to speed up their current methods of operation, without fundamentally altering the way they do business. Now, to be competitive, businesses need to restructure their operations to more fully integrate new computing technologies.

As information pathways expand and standardize, there is an increasing need for content developers and communication specialists who are able to maximize the effectiveness of new communication media. As the possibilities of ubiquitous computing become reality, the current focus on computing hardware as an end in itself is declining, and attention is shifting to the interactive communication capabilities afforded by computing. An understanding of human capabilities, interaction styles, and abilities are key factors in making new computing systems

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<sup>1</sup>Jeff Howell, personal conversation, June 1994.

<sup>2</sup> Hammer, M.J. & Champy, J., *Re-Engineering the Corporation*, Harper Business, NY, 1993.

successful. This demands not only technical expertise, but organizational and social knowledge as well.

## **Program Purpose and Goals**

**Purpose:** The Web has permanently changed how we solve problems today. In the past technology education was available in narrowly focused programs that address the development of a particular technology in isolation from other technologies. While new technology solutions are needed, there is a much larger need -- the successful deployment of integrated technologies. Today we rely on the integrated power of software, multimedia, databases, and networks to supply the information needed to stay competitive.

The focus of the academic discipline of information technology is to understand the fundamental problems facing business, industry, and education from the perspectives of users and to wisely apply available technologies to meet their needs. To develop an effective solution, employees are needed who can see and understand the “larger picture” – the needs of the enterprise as encompassed in the needs of the end users.

**Goals:** The MS program in Information Technology (MS/IT) offered by the department of Information Sciences & Technologies at RIT is designed to provide a highly flexible framework that allows each student to develop an individualized program of study that suits his or her own goals within the academic discipline of information technology. Starting with a background in fundamental information technology concepts, students have an opportunity to learn about the current themes and directions of information technology in the MS/IT core. Students can then select coursework from concentration areas across the diverse sub-disciplines of the field.

Coursework is available in website and interactive multimedia development; database design, implementation, and management; human-computer interaction and interface architecture; application development and software project management; networking, system administration, and computer security; computer game design and social networking; learning and performance technology; along with related topics from other departments at RIT. No other academic program has attempted such a marriage between these technical and non-technical fields.

## **Admissions Requirements**

Applicants must have a four-year baccalaureate or equivalent degree from a regionally accredited institution with a minimum cumulative grade point average (GPA) of 3.0 out of 4.0 (‘B’ average). Graduate level work in other disciplines will be considered. Applicants requesting consideration whose undergraduate GPA was less than 3.0 may be required to take the Graduate Record Exam (GRE) exam.<sup>3</sup>

International applicants must have prior academic performance equivalent to a 3.0 grade-point average or a first class diploma from an accredited four-year program. The GRE (standard examination) is required for all foreign applicants. International applicants must submit official transcripts for undergraduate (and any graduate) study in original form. If not originally in English, an official, certified copy of transcripts translated into English must also be included.

Applicants whose native language is other than English must submit a TOEFL<sup>3</sup> score to demonstrate strong English language skills. A minimum score of at least 570 (paper based), 230

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<sup>3</sup> RIT’s reporting number for ETS’s GRE and TOEFL examinations is 2760.

(computer based), or 88 (internet-based) is required. For other methods to satisfy the English requirement, contact the Office of Graduate Enrollment Services at (585) 475-2229 or email [gradinfo@rit.edu](mailto:gradinfo@rit.edu). Applicants with a lower TOEFL score may be admitted conditionally and will take a prescribed program in English along with a reduced program course load.

Other factors may be considered in the admission process such as strong employment history, especially in the field of information technology.

Entering students are expected to have background in the core information technology concepts. These competencies may be demonstrated by previous course work or by technical certifications and comparable work experience. Specific details are discussed in the “Prerequisites” section later in this document.

All applicants are required to submit the following:

- An electronic or paper application with a well-written statement of purpose that discusses your background, the MS/IT areas in which you would like to study, and your personal goals
- Application fee
- Valid transcripts from all universities listed on the application
- Declaration of Financial Support (international students only)
- Two recommendations from current educational or professional sources

An electronic graduate application is available at the URL [http://www.rit.edu/emcs/ptgrad/grad\\_admission.html](http://www.rit.edu/emcs/ptgrad/grad_admission.html) (Note: there is an underscore ( \_ ) between the ‘d’ in “grad” and the ‘a’ in “admission.”) This web site can also be reached from the “Apply Online” link in the Welcome section of the RIT home page (<http://www.rit.edu/>). Requests for information can also be made from this web site.

## **Starting your Program of Study**

Full-time students may begin their program of study in the fall quarter. Applications for part-time study are currently accepted for fall and spring quarters. The department offers a limited selection of courses in the summer quarter; however, it is typically not possible to obtain a full-time course load during this quarter.

## **Application Deadlines**

The application process typically takes four weeks after the Office of Graduate Enrollment Services (<http://www.rit.edu/emcs/ptgrad/index.html>) has received a complete application. However, foreign applications may take longer due to slow mail service and visa issues. Applications are only evaluated after all of the information has been submitted and verified by a counselor in RIT’s Office of Graduate Enrollment Services.

Students can be admitted at various times during the year. However, acceptance into the MS program does not guarantee availability of classes. As the start of the quarter approaches, many classes become full. Students, who apply just before the start of a quarter, may need to wait until the following quarter before starting their course work.

The standard application deadline schedule is shown below:

Quarter	Typical Starting Date of Quarter	Domestic Application Deadline (Part Time)	Domestic Application Deadline (Full Time)	International Application Deadline (Full Time only)
Fall	~ September 5	August 1	August 1	July 1
Winter	~ December 1	Not Permitted	Not Permitted	Not Permitted
Spring	~ March 7	February 1	Not Permitted	Not Permitted
Summer	~ June 1	Not Permitted	Not Permitted	Not Permitted

## Prerequisites

The MS/IT admission requirements include prior academic study and/or extensive work experience in fundamental information technology concepts. Specifically we require the following prior to admission:

- Solid skill in object-oriented programming, and
- Knowledge of computer hardware and software architecture.

In addition, before study in the MS program can be begun, we require pre-program prerequisite knowledge of the following:

- Fundamental computer networking concepts, and
- Basic web design and interactive multimedia concepts.

Prerequisite knowledge can be obtained through undergraduate or graduate coursework at RIT, equivalent course work at another university, or through documented training and significant work experience. Applicants are recommended to have all prerequisite knowledge prior to admission. The Graduate Program Coordinator may consider applicants without the required prerequisites at his/her discretion. However, an unusually strong background in information technology is necessary and additional coursework will be required to meet the outstanding deficiencies before study in the MS program can begin. All prerequisite work must be completed before study outside of the MS/IT core is initiated.

The Graduate Coordinator verifies that prerequisites have been satisfactorily completed. Coursework used to satisfy MS/IT prerequisites be successfully completed with the equivalent of a 'B' grade or better. If you have completed prerequisite work at another college or university, please have an official transcript sent to RIT. If you have equivalent work experience, write a letter to the Graduate Program Coordinator describing the work and requesting a waiver of prerequisite(s). Please provide sufficient detail so that the depth of experience and knowledge can be determined. Some form of verification, such as certified copies of training certificates or a letter from your employer on company letterhead, is also required.

Placement examinations are available periodically for some of the prerequisite courses. Information about these examinations is available from the department website (<http://ist.rit.edu/?q=node/98>).

The IST Department offers coursework to complete the program prerequisites as shown below. Prerequisites are listed in parenthesis after each course. Course descriptions are available at the end of this document and on the IST department website (<http://ist.rit.edu/?q=node/187>). These courses may not be used to satisfy any part of the 48-quarter credit hours required for the MS degree. Please meet with the Graduate Program Coordinator before beginning bridge study.

## The MS/IT Prerequisite Bridge Program

### Programming:

Prospective students who do not have a background in computer programming can take one of the following course sequences at RIT to complete the programming prerequisite:

- 4002-217<sup>4</sup> Programming for Information Technology I (Java)
- 4002-218 Programming for Information Technology II (Java; 4002-217)

Prospective students who have previous programming experience, but who need to learn a specific language, can take one (1) of the following:

- 4002-414 Java for Programmers (previous programming experience)
- OR
- 4002-714 Java for Programmers (previous programming experience; available in online format)

The amount of programming in each MS/IT concentration varies and some concentrations require a particular language or languages. The Java language is currently the primary language of the graduate program due to its visual interface capabilities and the usefulness in developing web-based applications. C++, along with UNIX/Linux (4050-402) and Perl (4050-521/4055-721), are used in the Networking/System Administration curriculum.

→ *Successful completion of this prerequisite is required before an application to the MS/IT program can be considered.*

### Hardware and Software Architecture:

Prospective students can take the following course at RIT to complete this prerequisite:

- 4050-350 Computer Platform Fundamentals (a discrete math course)

This course focuses on computer architecture from a hardware and software perspective, mostly at the microcomputer level. Topics focus on the underlying theory of components and peripherals along with software installation, configuration, troubleshooting, and maintenance. Available in on-campus format.

→ *Successful completion of this prerequisite is required before an application to the MS/IT program can be considered.*

### Networking and Data Communications:

The student can take one (1) of the following courses at RIT to complete this prerequisite:

- 4050-351 Computer Fundamentals (4050-350)
- OR
- 4055-746 Telecommunications Network Protocols (none; available in distance format)

These courses cover the basic concepts, theories, and components relevant to computer networking including electricity and magnetism, data encoding and transmission, topologies, protocols, and the OSI model. They are offered in on-campus or in online learning format.

→ *Students may be accepted into the MS/IT program before completing this prerequisite, but must successfully complete it during their first quarter of study in the program.*

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<sup>4</sup> Note: effective fall quarter of academic year 2001-2, the course numbers for Information Technology changed from 0602 and 0604 to 4002 and 4004 as part of the conversion to the B. Thomas Golisano College of Computing & Information Sciences.

### **Basic Web Site Design and Multimedia Concepts:**

The student can take one (1) of the following courses at RIT to complete this prerequisite:

- 4002-320 Introduction to Multimedia: The Internet & the Web (computer literacy)  
OR  
4004-741 Fundamentals of Web-Based Multimedia (computer literacy)

These courses cover key concepts necessary for a basic working knowledge of the World Wide Web, web page design and development, digital graphics, and interactive multimedia. They are both offered only in on-campus format.

→ *Students may be accepted into the MS/IT program before completing this prerequisite, but must successfully complete it during their first quarter of study in the program.*

### **Curriculum**

The MS/IT degree program consists of eleven (11) four-credit courses and a four-credit capstone experience for 48 quarter-credit hours of graduate study. The degree plan is composed of one core course, two or three student-selected concentrations, an elective, and the MS capstone.

#### **MS/IT Core (4 credits)**

The program core consists of one course (4 credit hours) which is designed to expose students to the breadth of opportunity in information technology and prepare them for developing a MS capstone topic:

- 4002-718 Current Themes in Information Technology

Students are expected to complete this core course during their first quarter of study in the MS program unless otherwise advised by the Graduate Program Coordinator. This course is available in both on-campus and distance formats.

#### **Concentrations (36 credits)**

A concentration is a group of three (3) or more courses that focus on a specific information technology area of knowledge. Each concentration is designed to explore, in some depth, a unique aspect of this diverse computing discipline. With the advice and approval of the Graduate Coordinator, the student combines concentration courses to create a plan of study. A plan of study can include all of the courses listed for a given concentration area or related coursework across concentration areas can be selected and combined. The overall plan of study must be academically cohesive, provide academic rigor, and support the student's personal goals.

Each student selects nine (9) courses to complete concentration study in at least two synergistic knowledge areas, within the academic discipline of information technology, as follows:

- Two concentrations: one with four (4) courses and a second with five (5) courses, or
- Two concentrations: one with six (6) courses and a second with three (3) courses, or
- Three (3) three-course concentrations in strongly related areas.

The standard concentrations areas and those pre-approved from other departments at RIT are detailed in subsequent pages.

### **Elective (4 credits)<sup>5</sup>**

MS/IT courses from concentrations not selected by the student may be taken as the elective. With approval of the Graduate Program Coordinator, an undergraduate IST course at the 4xx-level or above is acceptable if there is no graduate-level equivalent (see the Graduate Student Handbook for detail and excluded courses) and the student has not exceeded the three-undergraduate-courses rule. Graduate-level courses from other programs, such as Interactive Media Design & Imaging, Computer Science, or Business, are acceptable with prior approval from the Graduate Coordinator. MS/IT bridge courses or bridge courses from other MS programs at RIT may not be used as an elective.

### **Capstone Experience (4 or 8 credits)<sup>5</sup>**

The purpose of the MS/IT capstone is to allow students to demonstrate their creativity and professional capabilities in one or more of the concentration areas that they studied. The capstone requirement may be a MS project, 4002-898, or a MS thesis, 4002-897. Students must successfully complete a minimum of four (4) credits of capstone experience.

The project or thesis can be either 4 or 8 credits. Obviously an eight-credit project or thesis involves considerably more work than a four-credit version. Based on past history, approximately 90% of all students do a project, and nearly all MS theses and projects are four credits.

Students typically begin working on the capstone after they have completed all of their coursework. Each student assembles a capstone committee consisting of two (project) or three (thesis) faculty members who will guide the capstone experience and approve the final work. Students should anticipate spending approximately six (6) months in completing the MS capstone requirement. See the MS/IT Capstone Guide (<http://ist.rit.edu/?q=node/76>) for more information.

### **Standard Concentration Areas**

The department of Information Sciences & Technologies has designed the concentrations below to categorize our course offerings. The prerequisites for each course are given in parenthesis after the course name. The general prerequisites, required background for each concentration, and other relevant information are included below each list of courses. All concentration areas pre-suppose completion of the MS/IT bridge requirements. Depending upon faculty research and other initiatives, additional IST graduate or upper-level undergraduate coursework may be available.

The department updates courses and concentrations as technology advances. Your program worksheet is the framework for your graduate studies with us. Each student meets with the Graduate Program Coordinator and develops a plan of study from the available concentrations that suits his/her goals prior to beginning study. Plans of study are developed by selecting related courses from within and across concentrations that address these goals. If you started with us under a previous handbook and you have questions about changes to concentrations or course availability, contact the Graduate Coordinator.

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<sup>5</sup> Note: the total number of credits for the elective and Capstone Experience must sum up to 8.

## Website & Interactive Multimedia Design & Development

### Web Development

(offered in on-campus format)

Website development for an intranet or the World Wide Web; includes fundamental aspects of Web design (graphic design, XHTML, CSS, usability and semantics), programming, server administration, content management, marketing, testing and deployment.

4004-737 Website Design and Technology (4004-741)

4004-739 Programming for the World Wide Web (4004-737 and a two-course OOP sequence)

4004-751 Web-Database Integration (4004-739 and a database course)

Details: In addition to the courses above, 4004-745 is strongly recommended. Knowledge of relational theory and database development, equivalent to 4002-720, is required for 4004-751.

### XML Data Management

(offered in on-campus format)

eXtensible Markup Language (XML) is a markup, meta-language used to define data structures and complex documents for electronic data interchange and Web services.

4002-770 Introduction to XML (4004-737; 4004-739 recommended)

4002-771 XML Programming (4002-770, as pre- or co-requisite, and 4002-714)

4002-772 Transformation and Presentation (4002-770)

### Multimedia Application Development

(offered in on-campus format)

This concentration focuses on the creation of interactive software that combines text, 2D and 3D digital graphics, animation, still video images, full-motion images and sound for an in-depth study of multimedia concepts and the creation of interactive virtual worlds.

4085-727 Digital Audio and Computer Music (4004-730)

4004-730 Interactive Media Implementation (4004-741 and a two-course OOP sequence)

4085-746 Programming for Interactive Multimedia (4004-730)

4085-738 Multi-User Media Spaces (4004-746)

Details: Contact Prof. Biles ([jabics@rit.edu](mailto:jabics@rit.edu)) if you are interested in digital music.

### The User Experience

A study of the design, evaluation, and implementation of interactive computing systems and their impact on human beings – including the reasoning behind choosing specific functionalities.

#### Human-Computer Interaction<sup>6</sup>

(available on-campus and online formats)

4004-745 Foundations of Human-Computer Interaction

4004-748 Usability Engineering (4004-745 and 4004-730)

4004-749 Usability Testing (4004-748 and a statistics course; online requires one campus visit)

4004-755 Advanced Topics in HCI (4004-745)

4002-765 User-Centered Design Methods (4004-745)

4002-892 CSCW and Groupware (4004-745; offered only periodically)

Details: Students also need a solid background in basic web technologies (4004-741) and experience in multimedia programming (4004-730) for interface prototyping.

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<sup>6</sup> This concentration consists of selected coursework from our MS in Human-Computer Interaction (HCI). Contact Prof. Rozanski ([epz@it.rit.edu](mailto:epz@it.rit.edu)) for more information about these courses or this program.

## Interface Architecture<sup>6</sup>

(offered in on-campus format)

This concentration focuses on the visual perception, interaction style, and sensory aspects of creating functional user interfaces for computer-mediated experiences.

- 4085-757 Graphical Elements of the User Experience (4004-730)
- 4085-802 Perspectives on Computer Mediation (4004-730 and 4004-745)
- 4085-804 Building Tools for Creative Practice (4004-730 and 4004-745)
- 4085-855 Innovation and Invention (advanced expertise in a technical or creative discipline)

## Game Design<sup>7</sup>

(offered in on-campus format)

A study of the processes involved in the creation of interactive, computer-based games for entertainment, education, or training. Topics include the fundamentals of game play, defining game mechanics, creating narrative elements, and building a user community.

- 4085-791 History & Critical Analysis of Computer Games & Interactive Entertainment (graduate status)
- 4085-728 Interactive Narrative (4085-791 and (4004-737 or 4085-746))
- 4085-732 Game Design (4002-728)
- 4085-794 Online Identity, Social and Community Behavior (graduate standing and departmental approval)
- 4085-744 Building Online Communities (4004-794 and 4004-737)

Details: Requires creative writing and both formal and informal research activity, as well as a creative approach to content creation and social software construction. Readings on media theory and interaction are required. For more information, contact Prof. Stephen Jacobs at [sj@mail.rit.edu](mailto:sj@mail.rit.edu) and Prof. Elizabeth Lawley at [ell@mail.rit.edu](mailto:ell@mail.rit.edu).

## Application Development

(partially available in online format)

A study of the best practices for designing and building IT software solutions to suit the needs of users within today's enterprise domains.

- 4002-710 Object Technologies (4002-714; in-depth knowledge of Java) (available online)
- 4002-720 Data Modeling and Database Implementation (2-crs OOP sequence) (available online)
- 4002-725 Component Development (4002-710) (available online)
- 4002-784 Fundamentals of Database Client/Server Connectivity (4002-720)

Details: Students may want to consider including a project management course in this concentration. "Learn a language" programming courses (such as 4002-714, 4002-716, 4003-707, etc.) may not be part of a plan of study.

## Software Project Management

(available in online format only)

This concentration addresses the process of project management with an emphasis on the issues relevant to achieving successful software development projects within the enterprise domain; topics include software development planning, monitoring, costing, and control.

- 4002-830 Project Management
- 4002-831 Process Management
- 4002-820 Economics of Software Development (4002-830 & 831 recommended)

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<sup>7</sup> This concentration consists of selected coursework from the MS in Game Design & Development (MS/GDD). Contact Prof. Phelps ([amp@it.rit.edu](mailto:amp@it.rit.edu)) for more information.

Details: This concentration requires *two or more years of full-time employment experience* in the software development process *plus* solid programming skills. Students without this employment experience should consider a concentration in Information Systems from the College of Business; refer to the “Concentrations Offered by Other RIT Departments” section later in this document.

The faculty recommend that 4002-820 be taken last.

### Database Theory & Practices

(partially available in online format)

A study of the design, implementation, and management of database systems for the enterprise domain.

- 4002-720 Data Modeling & Database Implementation (2-course OOP seq.) (avail. online)
- 4002-784 Fundamentals of Database Client/Server Connectivity (4002-720)
- 4055-744 \*NIX Fundamentals (for Databases)
- 4002-774 Information Assurance Fundamentals (graduate standing in GCCIS)
- 4002-785 Fundamentals of DBMS Architecture & Implementation (4002-720 and 4055-744)
- 4002-787 Database Performance & Tuning (4002-785)
- 4002-789 Data Warehousing (4002-785)

Details: Students who have taken 4002-710 may also want to consider adding 4002-821, Data Architecture and Management (available online), to this concentration.

### eLearning Technologies<sup>8</sup>

(available on-campus and in online format)

These courses focus on the development of the learning materials and instructional programs that capture and disseminate the knowledge assets necessary for today’s digital academic, corporate, and governmental environments.

- 4002-722 Fundamentals of Instructional Technology
- 4002-723 Interactive Courseware (4002-722 and a 2-course OOP sequence)
- 4002-724 Performance Support Systems Design (4002-722)

Details: Contact Prof. Yacci ([mayici@rit.edu](mailto:mayici@rit.edu)) for more information.

### Bioinformatic Computing

(available on-campus only)

These courses provide an introduction to the field of biomedical informatics and the application of computing technologies to the organization, management, analysis and modeling of biomedical data.

- 4002-762 Introduction to Bioinformatics Computing (4002-714 and 1016-265)
- 4002-763 Advanced Bioinformatics Computing (4002-762)
- 1001-724 Advanced Data Management Seminar (4002-720; note: 3 credit course)

Details: This concentration area requires background in discrete math (1016-265) and computer programming. Background in biology is helpful but not required. Contact Prof. Anne Haake ([arhics@rit.edu](mailto:arhics@rit.edu)) for more information on 4002-762 and -763. Contact Prof. Mike Osier ([michael@bioinformatics.rit.edu](mailto:michael@bioinformatics.rit.edu)) about 1001-724.

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<sup>8</sup> This concentration is comprised of selected coursework from our MS in Learning and Knowledge Management Systems (<http://www.it.rit.edu/?q=node/30>).

**Note:** The concentrations below are all offered through collaboration with the Networking, Security & System Administration department. A maximum of four (4) courses in networking or system administration may be included in the MS/IT degree.

### Networking, Network Security & System Administration

#### Networking<sup>9</sup>

(available in online format unless noted otherwise)

These courses cover concepts fundamental to the process of how computers communicate with each other to share resources and information across a computer network. Issues related to network scale, connection methods, architectures, and topologies are addressed.

4055-761 Principles of System Administration (4055-746)

4055-755 Secure Wireless & Wired Data Networks (4055-746)

4055-815 Introduction to Routing and Switching (4055-746) (not online)

Details: Familiarity with networking theory (4055-746) and the UNIX/Linux operating system are necessary. Knowledge of shell scripting is desirable.

#### System Administration<sup>9</sup>

(available in online format unless noted otherwise)

These courses address the fundamental issues in operating and maintaining a computer system or network, specifically installing, supporting, and maintaining servers and network services, and planning for and responding to threats and other service problems.

4055-721 Perl for System Administration (two-course OOP sequence) (not online)

4055-761 Principles of System Administration (4055-746)

4055-780 Computer System Security (4055-761) (not online)

Details: Familiarity with networking theory (4055-746) and the UNIX/Linux operating system are necessary. Knowledge of shell scripting is required.

#### System Survivability<sup>9</sup>

(partially available in online format)

This concentration addresses the basic security topics necessary for administering Web-facing and network-accessible business systems. Topics include deploying software patches, preventing break-ins, and other preventative measures such as firewalls and intrusion detection systems.

4055-761 Principles of Sys. Administration (4055-746)

4055-755 Secure Wireless & Wired Data Networks (4055-746)

4055-780 Computer System Security (4055-761) (not online)

Details: Familiarity with networking theory (4055-746) and the UNIX/Linux operating system are necessary. Knowledge of shell scripting is required.

Students interested in computer crime or ethics may also be interested in:

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<sup>9</sup> A fourth course may be included with permission of the Graduate Coordinator; pre-approved options are:

4055-850 Network Design and Performance (4002-455, 4055-746, 4055-761)

4055-862 Advanced Routing Protocols (4055-746; 4055-815 recommended)

4055-882 Enterprise Security (4055-746)

4055-886 Security Audits of Web Servers & Applications (4055-780)

- 0501-707, Computer Crime (contact RIT's Criminal Justice department at (585) 475-2432)
- 0101-745, Legal and Ethical Issues in Technology Intensive Environments (contact Prof. Oliver in the Saunders College of Business at (585) 475-6668 or [boliver@saunders.rit.edu](mailto:boliver@saunders.rit.edu))

### Special Topics

One (1) special topics concentration may be requested. This option can be used to design a concentration from other courses offered by the IST department, graduate coursework from other departments at RIT, or graduate coursework from other universities. All applicable prerequisites must be completed. Prior approval of the Graduate Coordinator is required. See the "RIT Policies and Regulations" section of this handbook for more details.

Depending upon individual student goals, additional graduate or IST undergraduate coursework may be available for some of the topic areas above.

## Concentrations Offered by Other RIT Departments

MS/IT students can include up to a maximum of 12 graduate credits from other departments at RIT in their plans of study, with the prior permission of the Graduate Coordinator. The following concentrations are pre-approved. Contact the department offering the courses for prerequisite questions, course descriptions, and scheduling information.

Business<sup>10</sup> - Offered by the Saunders College of Business. Contact Ms. Peggy Tirrell at [ptirrell@saunders.rit.edu](mailto:ptirrell@saunders.rit.edu) or (585) 475-2795 for information.

### Technology Management (available in on-campus format unless noted otherwise)

Technology management addresses the responsibility of business organizations to identify, introduce, and monitor the assimilation of computing technologies.

0102-742 Technology Management (0102-740)

0102-761 Managing Research & Innovation (0102-742)

0102-762 Managing New Process and Product Development (0102-742)

Details: These courses require the prerequisite course 0102-740 Organizational Behavior and Leadership (available in on-campus and online formats). Students without this background, can include 0102-740 one of the courses in this concentration.

### Information Systems (available in on-campus format unless noted otherwise)

These courses address the application of information technologies to the business functions through which organizations capture, transmit, store, retrieve, manipulate, and display information.

0112-720 System Analysis & Design I (programming experience)

**And** two (2) of the following:

0112-755 Information Technology Strategy & Management (0112-710)

0112-760 Integrated Business Systems (familiarity with MS/Office Suite and browsers)

0112-761 Business Process Analysis and Workflow Design (familiarity with MS/Office Suite and Web browsers)

Details: The standard prerequisite course, 0112-710, is waived for MS/IT students.

### eCommerce (available in on-campus format unless noted otherwise)

Ecommerce refers to the business processes involved in conducting commerce with goods and services over the Web.

0112-755 Information Technology Strategy & Management (0112-710)

0105-761 Marketing Concepts (none)

0105-772 Internet Marketing: Strategies & Tactics (0105-761)

Students may also want to consider either of the following as part of a business concentration or as the MS/IT elective:

- 0106-744, Project Management
- 0110-745, Legal and Ethical Issues in Technology Intensive Environments (contact Prof. Oliver in the Saunders College of Business at (585) 475-6668 or [boliver@saunders.rit.edu](mailto:boliver@saunders.rit.edu))

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<sup>10</sup> Due to the Saunders College of Business's AACSB accreditation regulations, students matriculated in programs outside of that college cannot take more than four (4) graduate business classes.

### Telecommunications Technology

(available in both on-campus and online formats)

Telecommunications is the exchange of information over a distance via any cable, wire, radio, optical, or other electromagnetic systems. Offered by the ECT Engineering Technology (TET) Department. Contact Prof. Warren Koontz at (585) 475-5706 or [wlkmet@rit.edu](mailto:wlkmet@rit.edu).

0614-722 Principles of Telecommunications Networks (4055-746)

**And** two (2) other courses in consultation with the Graduate Coordinator and TET

Details: 0614-722 should be completed before other courses are taken.

### Automated Manufacturing

(partially available in online format)

Automated manufacturing is the application of mathematics, robotics, metallurgy, programmable machinery, and computer-assisted machining techniques to create computer-enhanced manufacturing processes. Offered by the Manufacturing and Mechanical Engineering Technology department; contact Prof. Ramkumar at (585) 475-6174 or [smrmet@rit.edu](mailto:smrmet@rit.edu).

0617-870 Manufacturing Automation Controls (available in online format)

0303-729 Advanced Systems Integration (C++; call (585) 475-7142 for more information)

**And** another course in consultation with the Graduate Coordinator

### Health Systems Administration

(available in online format)

These courses address the development, structure, and current forces – including the application of computing technologies – that are transforming health care today. Offered by the Hospitality and Service Management; contact Dr. Underhill at [lmuis@rit.edu](mailto:lmuis@rit.edu) or (585) 475-7359.

0635-752 Clinical Information Systems

0635-754 eHealth

**And** another course in consultation with the Graduate Coordinator

Details: These courses may be taken in any order. A 4-course certificate is also available.

### Computer Graphics

(available in on-campus format only)

The design theory, methodology, and aesthetics of creating 2D and 3D graphic images with a computer – primarily for entertainment and interactive multimedia installations.

2014-721 3DDG Modeling **and** two (2) from the following:

2014-722 3DDG Interactive Motion

2014-731 3DDG Lighting (2014-721)

2014-732 3DDG Shading (2001-721)

2014-733 3DDG Character Design (2014-721)

2014-747 3DDG Rendering (2014-721)

2014-798 3DDG Production Pipeline (2014-721 plus at least one other 3DDG course)

2014-75x Special Topics (as required by topic)

Details: Offered by the Interactive Media Design & Imaging (IMDI) department in the College of Imaging Arts & Sciences; contact Prof. Marla Scheppe at (585) 475-2754 or [mkspph@rit.edu](mailto:mkspph@rit.edu). MS/IT students are welcome to join the IMDI department's student SIGGRAPH organization.

## **Computing Facilities**

The computing facilities of the department of Information Sciences & Technologies are driven solely by curricular needs. Our focus for the computers and networks that we provide is the needs of our students. Students use our labs to investigate concepts, and to design and develop content for either stand-alone computers or network delivery. Many of our students also work as lab assistants, adding an additional practical dimension to their educational experiences.

Many IST courses are laboratory-based. Some courses have separately-scheduled laboratory sessions in which an instructor provides a structured learning experience that reinforces lecture concepts. Other courses are taught in specially-designed “active learning labs” in which each student has a computer. These courses use alternating lecture and hands-on sessions to facilitate active learning. The labs also have display facilities with one or more large screens located at the front of the room so students may see demonstrations of work and immediately apply them.

Our Open Lab provides students with access to generalized computing resources outside of scheduled lab and class times. In addition this facility, the IST department has specialized laboratories that support curriculum in the areas of website design, streaming media, computer gaming, human-computer interaction, programming, and database implementation and administration. Due to our cross-platform commitment, many of computing labs contain both Windows and Macintosh platforms. UNIX is used in several specialized labs.

The IST department’s Database Labs are designed to facilitate experimentation with database administration, client/server access, and database performance concepts. The labs have benches with machines that support both the Windows and Linux operating systems that can be configured as either servers or clients. Students can begin by configuring single-user, 1-tier environments and progress to multi-tier networked configurations, where multiple clients interact with typical database management software (DBMS), such as Oracle, through middle-tier or web server environments. Special high-end rack-mounted servers are available for the exploration of database performance issues and data warehousing design and implementation.

The IST Streaming-Media Lab houses the department’s video and audio studios that support sound and video content creation for digital video and animation courses. The digital video production studio has a “talk show style” set for streaming video productions, SDI cameras, and a chroma key screen. The lab’s audio studio is designed for both voiceover/narration work and for groups of three or four performers to do dialog work or record music. In addition to supporting class work, it is creative environment available for student and faculty use. The two studios are linked by a professional, digital control room complete with sound board, professional-quality microphones, and industry-standard sound editing equipment, as well as video switchers, encoders, and media servers.

The IST usability testing facilities have state-of-the-art networked PC and Macintosh computers with a selection of input devices such as touch screens, joysticks, haptic mice, track balls, etc. The testing facilities have security-style video cameras that can record activities for the observer, high-quality desk microphones to record the user’s comments (and to act as an intercom), a microphone/headset for speech input, and a scan converter for recording an active subject computer. The observer can monitor the display of the user’s screen and utilize equipment for note taking, communication, and session recording.

Our students may also take courses from the Networking, Security, and System Administration (NSSA) and from the Interactive Games & Media (IGM) departments, both of which has extensive laboratory facilities to support their curriculum. For NSSA, these include computer networking, system administration, telephony and data integration, security, and projects labs that are designed to facilitate the exploration of computer networking. Extensive testing and

cabling equipment, a wide variety of network appliances, and flexible topology options – via direct connection and roll-around racks – support coursework, special projects, and graduate capstone study. IGM has labs with high-end PCs and dual-screen setups for multi-user game development, along with a collaborative lab space with Macintosh computers for interactive multimedia and social media development.

Our computing facilities are connected to the RIT gigabit campus backbone which has OC3 connections to the Internet. Students have access to RIT facilities from their dorm rooms, wireless access points in campus buildings and from off-campus locations. Institutional facilities provide locations for students to develop their own presence on the Web. The overall campus facilities have consistently been rated in the top twenty universities by national surveys.

The general and specialized facilities make our computing environment one of the most up-to-date for innovative exploration of information technology concepts of any university in the United States.

## Online Learning Option

Portions of this degree can be completed through our online learning (distance) option. With this option, there is no residency requirement. The core course is available in distance format. Prerequisite courses, if needed, are available either through our online offerings or can be completed at another convenient university.

With online learning at RIT, the learning experience is location independent. However, there are scheduled assignment and meeting times. The students and instructor typically interact over the web using conferencing software for the Macintosh and PC platforms that provides presentation, email, discussion groups, file transfer, and chat facilities. Courses may also use RIT's audio bridge for class-wide conference calls.

Visit <http://online.rit.edu> for more information on online learning at RIT.

The following concentrations are entirely available through RIT's online learning option:

- Telecommunications Technology (ECT Engineering Technology Department)
- Health Systems Administration (Department of Hospitality & Service Mngt.)
- Software Project Management (with appropriate background; contact Graduate Coordinator)

The following concentrations are offered both on-campus and through distance learning:

- Application Development (selected courses only; see MS/IT Concentrations section)
- Learning and Performance Technology
- Human-Computer Interaction (selected courses only; see MS/IT Concentrations section)
- Networking (selected courses only; see IST Concentrations section)
- System Administration (selected courses only; see MS/IT Concentrations section)
- System Survivability (selected courses only; see MS/IT Concentrations section)

The following concentrations are only offered on-campus:

- Website & Multimedia Design & Development concentrations
- Interface Architecture and Game Design
- Database (except for 4002-720 which is offered online too)
- Bioinformatics
- Technology Management, Information Systems, and eCommerce (Saunders College of Business)
- Computer Integrated Manufacturing (College of Engineering)
- Computer Graphics (Interactive Media Design & Imaging department, College of Imaging Arts & Sciences)

Students in the Rochester area may choose to study in either format depending upon personal preference and course availability.

## **Cooperative Work Experience**

The MS in Information Technology program includes an optional cooperative work experience (coop). There is no tuition fee for coop, since it is treated as a zero-credit course. Salaries typically range from \$10 to \$30 per hour, depending upon position and area of the country. While you won't earn enough to pay your tuition expenses, you can earn money to help support your living expenses. Plus the work experience gained through coop can help you start your career in IT.

Graduate students may do a maximum of 2 quarters of co-op after all pre-requisites, including any required English preparation study, and 2/3 of the program has been completed with 3.0/4.0 GPA or better. Full eligibility details are included in the Graduate Student Handbook.

## **Time for Campus Courses**

Nearly all of our on-campus classes are offered evenings starting at 6:00 pm at least once during each academic year. The more popular courses are also offered during the daytime hours: mornings, afternoons, or late afternoons.

## **RIT Policies and Regulations**

### **Transfer of Credit**

A student may propose to transfer up to twelve (12) quarter-credit hours (nine semester-credit hours) into this program. The courses must be graduate level, directly relate to the MS/IT program, and have been taken at a regionally accredited university within the past 5 years with a grade of 'B' or better. A written proposal that addresses the relevance of the course(s) to the student's MS program should be submitted to the Graduate Program Coordinator who will evaluate each request and determine credit transferability.

### **Courses from Other Colleges or Universities**

A student may propose taking up to three (3) graduate-level courses from another college at RIT or another university (see credit transfer discussion above) as a concentration or taking one course as the elective. Outside undergraduate courses cannot be approved. Please submit a written proposal that addresses the relevance of the courses to your MS studies to the Graduate Coordinator for approval. For currently enrolled students, the proposal must be submitted and approved before the course(s) are taken.

No additional approval is needed if you take the courses outside of the IST department that are listed in the pre-approved concentrations. If you take courses from other departments or universities without prior approval, there is the possibility that the courses will not count towards your MS/IT degree.

### **RIT's 7-Year Degree-Completion Rule**

A student must successfully complete all of the requirements for his or her MS program within seven (7) years of the date of the first (oldest) course counted towards the student's degree. This requirement includes courses transferred into the program from other RIT departments or other universities, but excludes prerequisite courses. For example, if the first course was completed in fall quarter 2009 (20091), then the program must be completed by the end of fall quarter 2016 (20161; November 2016). Please contact the Graduate Coordinator immediately if you find that you are coming close to your 7-year deadline.

## **Undergraduate Courses**

A graduate student may request that up to three (3) upper-level undergraduate courses from the department of Information Sciences & Technologies be used towards the student's plan of study. The courses must have a number of 400 or greater. The courses must be selected in areas of study where equivalent graduate-level courses are not currently available. Permission of the Graduate Coordinator must be obtained before each course is taken. Undergraduate courses in other RIT departments may not be used towards the MS degree.

## **Academic Honesty**

Academic honesty is an expectation of all students at RIT. The RIT code of academic conduct is documented in the college Policies and Procedures manual; it is available online. The IST department's academic honesty policy is also posted on the departmental website (<http://ist.rit.edu/?q=node/108>). Additional details of the ramifications of violating these policies are available in the Graduate Student Handbook.

## **Other Useful Information**

Full information on all policies and useful contacts at RIT is in the Graduate Student Handbook which is available on the IST department website.

## **Contact Information**

Please visit the department of Information Science & Technologies' web site at <http://ist.rit.edu> for more information and the main RIT web site at <http://www.rit.edu> for general information on RIT and links to all programs. More information on the Distance Learning program can be found at the web site <http://online.rit.edu/>.

For additional information on this program, please send email requests to [gradinfo@it.rit.edu](mailto:gradinfo@it.rit.edu).

To schedule an appointment (in person, via the telephone or through an IM chat) with the Graduate Coordinator, contact the Student Services office during normal business hours (8:30 am to 4:30 pm USA Eastern Standard Time) or send email. Contact information is shown below.

### **US Mail:**

Graduate Coordinator  
School of Informatics, GCCIS  
Rochester Institute of Technology  
102 Lomb Memorial Drive  
Rochester, New York 14623-5603

**E-mail:** [InformaticsGrad@rit.edu](mailto:InformaticsGrad@rit.edu)

**Telephone:** (585) 475-2700 (v/tty)

**FAX:** (585) 475-6584

## Course Descriptions for Information Sciences & Technologies Courses

Course descriptions for graduate and undergraduate information technology courses (4002- xxx) offered by the Information Sciences & Technologies (<http://ist.rit.edu>) department are available on the department website at <http://ist.rit.edu/?q=node/187>. Select “Information Sciences & Technologies” from the department pull-down menu.

## Graduate Course Descriptions for Website Development Courses

Course descriptions for graduate website Development courses (4004-xxx) offered by the Information Sciences & Technologies department are available on the IST website at <http://ist.rit.edu/?q=node/187>. Select “Information Sciences & Technologies” from the department pull-down menu.

## Course Descriptions for IGM Courses

Course descriptions for graduate (4085-xxx) and undergraduate (4080-xxx) game and multimedia courses offered by the Interactive Games & Media department (IGM; <http://igm.rit.edu>) are available on the IST website at <http://ist.rit.edu/?q=node/187>. Select “Interactive Games & Media” from the department pull-down menu.

## Course Descriptions for NSSA Courses

Course descriptions for graduate (4055-xxx) and undergraduate (4050-xxx) computer networking, system administration and network security courses offered by the Networking, System Administration, and Security department (NSSA; <http://www.nssa.rit.edu>) are available on the IST website at <http://ist.rit.edu/?q=node/187>. Select “Networking, Security & System Administration” from the department pull-down menu.

Information about course availability is on the RIT website at <http://register.rit.edu/courseSchedule/>. You will need to select a specific academic term.

Academic terms at RIT are each 10 weeks long and identified by a 5-digit code: *yyyyn*, where *yyyy* is the calendar year (i.e. 2009) at the beginning of the current academic year (i.e. 2009-10) and *n* designates the term (1 = fall, 2 = winter, 3 = spring, and 4 = summer).

RIT courses are identified by a 9-digit code which specifies department (*d*), course number (*c*) and section (*s*) number: *ddd-ccc-ss*. Day sections are generally designated as *0s* or *1s*. Evening sections are generally designated *7s* and *8s*. Blended sections, which meet both on-campus and online each week, are generally designated *3s*. And online sections are designated *9s*.

## **2009-2010 Academic Calendar**

(not included)

## **2010-2011 Academic Calendar**

(not included)

# **Worksheet for MS in Information Technology**

(not included)